

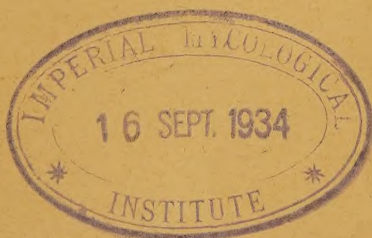


TANGANYIKA TERRITORY

DEPARTMENT OF AGRICULTURE

Annual Report

1933



1934

DAR ES SALAAM

PRINTED BY THE GOVERNMENT PRINTER

Shs. 2/50 (2s. 6d.)





TANGANYIKA TERRITORY
DEPARTMENT OF AGRICULTURE

Annual Report

1933

1934
DAR ES SALAAM
PRINTED BY THE GOVERNMENT PRINTER



Annual Report

1911

CONTENTS.

REPORTS ON :—

1. STAFF.
2. FINANCE.
3. GENERAL REVIEW.
4. NOTES ON THE CHIEF EXPORT CROPS, ETC.
5. PROGRESS (including trials of new crop varieties, etc.) IN THE VARIOUS PROVINCES :

- (i) North-Eastern Circle :
Northern Province.
Tanga Province.
- (ii) North-Western Circle :
Lake Province.
Western Province.
- (iii) South-Eastern Circle :
Lindi Province.
- (iv) Eastern Province.
- (v) Iringa Province.
- (vi) Central Province.

6. ANNEXURES :

- (i) Report of the Senior Agricultural Officer, North-Eastern Circle.
- (ii) Report of the Senior Agricultural Officer, North-Western Circle.
- (iii) Report of the Senior Agricultural Officer, South-Eastern Circle.
- (iv) Report of the Acting Entomologist.
- (v) Report of the Mycologist.
- (vi) Report of the Senior Agricultural Assistant, Morogoro.
- (vii) Report of the Morogoro Agricultural Station.
- (viii) Report of the Ukiriguru Agricultural Station.
- (ix) Extracts from the Report of the Agricultural Lecturer on the Nyakato Agricultural Training Centre.

7. APPENDICES :

- (i) List of Staff.
- (ii) Plant Introduction.
- (iii) List of Ginneries.
- (iv) Crop Export Statistics.
- (v) Summary of Expenditure from 1st January to 31st December, 1933.



Digitized by the Internet Archive
in 2025

DEPARTMENT OF AGRICULTURE.

ANNUAL REPORT, 1933.

STAFF.

The Director was absent on leave from February to August, and Mr. A. J. Wakefield, Senior Agricultural Officer, served as Acting Director during the period. Mr. L. A. W. Vickers-Haviland from the Administration served the whole year as Assistant to the Director. It should be noted that the Technical staff in Head Office consists of the Director with the part-time daily services of the Senior Agricultural Assistant.

At the close of the year the staff authorized was :—

Head Office : Director; Assistant to Director; three European Clerks and part-time assistance from the Senior Agricultural Assistant.

Scientific Staff : Entomologist; Assistant Entomologist; Mycologist.

Field Staff : Three Senior Agricultural Officers; Agricultural Lecturer; twenty-four District Agricultural Officers; one Senior Agricultural Assistant; fifteen Agricultural Assistants.

The following changes of staff took place during the year :—

- (i) *New Appointments*.—Mr. S. M. Gilbert, Chief Scientific Officer, Mr. H. B. Stent, Agricultural Chemist; Messrs. R. C. Jerrard, M. Wright and H. Gillman, Agricultural Assistants; Messrs. R. Seager, A. E. Twells and A. E. Weirich, Temporary Agricultural Assistants, and Mr. J. B. Hean, European Clerk.
- (ii) Messrs. D. G. Burns and J. E. Bruce, District Agricultural Officers; Messrs. J. S. Scott, F. H. Smith, R. C. Jerrard and M. Wright, Agricultural Assistants, left the service.
- (iii) Mr. J. V. R. Brown, District Agricultural Officer, seconded to Zanzibar, rejoined the department.

FINANCE.

Attention is drawn to the fact that the expenditure on the department is now balanced, in part, by revenue collected in return for specific services, and by a contribution from the Empire Cotton Growing Corporation which is most gratefully acknowledged. For instance, coffee grading at Bukoba yields a revenue of about £2,000 per annum. The cotton cess yields a revenue of £2,750 per annum which meets expenditure incurred in the supervision of this crop in the field, but this expenditure now appears as an item in the votes of the department, and is not now self-balancing as in 1931 and 1932. In addition the revenue accruing from produce, seeds, and so forth from experimental farms is increasing and now represents about £600 per annum, and there is the contribution of £1,000 from the Empire Cotton Growing Corporation. Thus the total direct revenue may be estimated as $2,000 + 2,750 + 600 + 1,000 = £6,350$ per annum or over 10 per cent. of the total vote for the department.

Economies effected and vote reductions since 1930 are reasonably reflected in the following set of figures which represent the Estimates of expenditure on the votes proper excluding extraordinary expenditure :—

		Personal Emoluments		Other Charges		Total
1930-31	...	38,081	...	27,000	...	65,081
1931-32	...	40,230	...	25,893	...	66,123
1932-33	...	35,426	...	26,929	...	62,365
1933	...	35,112	...	26,844	...	61,956
1934	...	35,754	...	23,072	...	58,826

In every year the actual expenditure is less than the estimate, due to careful supervision of expenditure. It is to be noted that since 1932, Personal Emoluments have scarcely increased, although annually provision of about £1,000 has to be made to cover normal salary increments. This has been made possible only by staff retrenchment. A fall of approximately £7,000 is shown in the Estimates since 1931-32 equivalent to over 12 per cent. of the vote and in the same period the direct revenue of the department has increased from about £1,000 to over £6,000 per annum. It is to be noted that 33 per cent. of the total under "Other Charges" is provided as contributions to Amani, and to other agricultural activities outside the Territory; the amount of other charges available for expenditure in the Territory for purely departmental purposes is about £15,000.

The appropriation for this department has fallen dangerously low. Recourse to outside sources for assistance has had to be made, to maintain and develop absolutely essential work within the Territory. These fortunately have responded generously, and the willingness of planter communities to submit to special imposts for the purpose of supporting agricultural investigation is a very satisfactory feature. Native Authorities too are helpful, but the amount of assistance they give bears no great relation to the importance of agricultural work and development in connection with their source of income. It is confidently hoped, and there are some reassuring signs, that Native Authorities will in future more generously support and further the work.

A table showing the provision made for expenditure during 1933 and the estimated amount expended during the year will be found in Appendix V.

GENERAL REVIEW OF THE YEAR.

(By the Director.)

The season was unpropitious, rains came early but finished very early, with the result that acre outturns were reduced and on account of the native propensity for late planting many plots gave no harvest. In usually favoured areas like the sides of hills, in Bukoba and in the Northern Province there was a shortfall in total rain, but it was serious enough only to cause anxiety. Large areas of the Territory received so little rain that the yield of sorghum and millet was halved. This crop is very drought-resistant and when it is seriously reduced, many other crops are almost failures. Locusts were present in certain areas and food shortages have been frequent, and these shortages have revealed the evasion of some native people who failed to plant cassava. One tribe, on the advice of a witch, destroyed all its growing crop of Bambarra groundnuts, needless to say to-day it is somewhat hungry. In Handeni, where there was a food shortage in the eastern area, and preparations were being made to issue famine food, it was noteworthy that in the western part people at once ceased to harvest their cotton, because they expected to be fed free.

The above indicates in a way the kind of native material found in some parts of the Territory; fortunately it is not general.

The areas in which the drought was more pronounced were Morogoro, Dar es Salaam, Bagamoyo, Handeni and the Pares.

The need for additional and extended planting by natives of all, and especially export, crops was again stressed, and, in the more receptive areas, the reaction was very good indeed. Thus, despite an adverse season and lower prices, the tonnage of export production of native crops has been more than maintained, and although deprived by the season of bounteous harvests, increases in tonnage exported of all the more important crops over the 1932 output are to be recorded.

Records have been created in the export of seven commodities, but the total tonnage of domestic exports is only 11 per cent. greater than in 1932, so that the desired figure of 165,000 tons is still a fair way off but, considering season and locusts, production was good. In last year's report a table was printed showing the record production of each commodity and the outturn for each of three years. This has been brought up-to-date, and shows that the 1933 figures of export of sisal, coffee, beeswax, groundnuts, cotton, rice and hides and skins are record figures for those seven products.

Product	Maximum Output for Export prior to 1933	1931					1932					1933					Amount of Preference granted in accordance with the Ottawa Agreement No. 1355 of 25th November, 1932.
		Amount	Total value	Value per ton F.O.B.	Amount	Total value	Value per ton F.O.B.	Amount	Total value	Value per ton F.O.B.	Amount	Total value	Value per ton F.O.B.				
Sisal ...	Year 1932	Tons 60,554	Tons 55,939	£ 707,177	£ 12 13	Tons 60,554	£ 698,056	£ 11 10	Tons *69,600	£ 881,772	£ 12 13	U.K. 10% <i>ad val.</i> , India 10%					
Hides and Skins	1913	3,456	2,111	83,915	39 15	2,718	99,474	36 12	*4,140	165,382	39 11	Nil.					
Cotton Lint	1929	4,947	2,426	119,752	49 7	3,209	183,747	57 5	*5,075	276,864	54 11	Nil.					
Copra ...	1928	9,318	7,234	62,209	8 12	7,265	64,694	8 18	8,157	62,160	7 12	U.K. 10% <i>ad val.</i> , India 10%					
Groundnuts	1924	18,684	3,070	28,706	9 7	15,873	182,010	11 9	*19,177	166,223	8 13	U.K. 10% <i>ad val.</i>					
Beeswax ...	1931	607	607	47,010	77 9	391	31,965	81 15	*680	52,751	77 11	U.K. 10% <i>ad val.</i>					
Coffee ...	1930	11,547	9,251	247,037	26 14	11,362	463,597	40 16	*12,718	429,523	33 15	Per lb. U.K. 1d., New Zealand 1d., New Foundland 2c., India 1s., South Africa 1d., Southern Rhodesia 1d., U.K. 10% <i>ad val.</i>					
Sesame ...	1932	4,811	3,828	36,715	9 12	4,811	50,130	10 8	4,441	41,845	9 8	Per lb. U.K. 1d., (clean husked).					
Rice ...	1932	5,385	4,754	51,209	10 15	5,385	62,939	11 14	*6,293	62,382	9 18	Nil.					
Millet and Mfama	1928	7,732	5,270	20,710	3 18	3,529	14,911	4 4	2,845	10,560	3 15	U.K. 10% <i>ad val.</i>					
Maize ...	1932	2,823	1,769	7,401	4 4	2,823	11,999	4 5	868	2,665	3 1	Nil.					
Gums (Arabic and Copal)	1932	1,033	482	10,583	22 0	1,033	15,540	15 1	1,015	15,239	15 0	Nil.					
Ghee ...	1913	1,287	293	11,549	39 8	359	16,848	46 19	480	19,586	41 4	Nil.					
Total ...		132,184	97,034	1,433,973	14 16	119,312	1,898,056	15 18	135,489	2,186,952	16 2						

*New high record export tonnage.

The problem of making this Territory pay its way does not depend altogether on a rise in value per ton of its exports, but it very much depends on the number of tons of surplus produce sent out over the railway system and through the ports. If, by an increase in internal traffic and export tonnage, we can considerably reduce the deficit on railway working and interest charges, the added return traffic should entirely obliterate the loss. An increase in value alone would help by engendering return traffic, but it is surely obvious that the surplus production of Tanganyika is very small for such a big country with a five-million population.

The "plant more crops" campaign thus has more than preserved the export tonnages of the Territory through an adverse and droughty season, and the policy may be said to have been justified. It must, however, lead to a permanent increase, and to one achieved without it becoming more necessary to exhort and advise to maintain enthusiasm. To this end trade exhibitions are important to foster and maintain the desire for novelties and useful articles which to-day are so cheap and attractive.

At the latter end of 1930, because obviously native effort would be at a low ebb chiefly as a result of the catastrophic fall in prices, officers of the department were instructed to stress and to point out to the native that "if he desired to maintain his old cash income, he should either farm better or do more farming, or both." As reported in 1931, and as was obvious from the export surpluses of that season, there was little real response to their advice. The policy of encouragement was adopted generally towards the end of 1931 and all Government field officers were expected to preach production. The department thus became heavily involved in an effort designed to save the people and their institutions and possibly the Territory from considerable financial embarrassment. In directing the energies of field officers of this department to this essential work, in placing every available man in the field and in fostering the team spirit in districts, the proper functions of the department were not lost sight of, although the emergency dominated the situation. In addition the ever recurring anti-locust activities have diverted officers from purely agricultural and particularly from experimental work of local value.

However, gradually and steadily dispositions were made to achieve some of the necessary developments, and to prosecute pressing investigations into the production and marketing of some of the staple native agricultural products. Furthermore, in order that in due course Native Authorities could become more fully identified with agricultural work in their areas, large farms have been sought, typical of the districts concerned and a small portion of each has been developed as a departmental experimental station, leaving the rest of the farm available when further and extended training is desired by the people. Also serious efforts have been made to secure and equip experimental and research stations to deal with certain major crops primarily, and to deal with crops which go with them either as alternates or intercalary. Data from experimental work are sorely needed in order that advice may be based on facts gleaned locally, and if possible in the district in which the advice is proffered. Recognizing that much of the function of the department is educational as well as being advisory and supervisory, there has been a trend towards the establishment of training centres, and as the orderly marketing of native crops is of great importance in maintaining enthusiasm, and of assistance in improving quality, we have been closely concerned in that aspect of production. It is becoming clear that the work of the department has expanded considerably,

purely field work will have to take a less prominent place and the trained agriculturist must prosecute studies and do work where he can get data of permanent value. The need for co-operation with other departments, cognate to this, has long been stressed; and it is hoped that, by working arrangements, the field time of agricultural staff will be economized whilst, at the same time, the dissemination of agricultural advice will be intensified. Furthermore, it is recognized that the stimulation of native agricultural effort is an administrative matter.

DEVELOPMENT.

Development is proceeding steadily on a scale commensurate with the indicated progress of the Territory. It is largely financed by money made locally and does not represent any appreciable inflow of capital. A number of sisal estates have managed to arrange finance for decorticating machinery, the spurt in sisal values no doubt being helpful.

There is a quiet but steady planting of coffee, both on the part of planters and natives, and preparations are being made by an established firm in Bukoba to modify and bring up to date a coffee-cleaning works. The finance for the coffee factory in Moshi failed to materialize, but another person, with strong local cash reserves, applied. The position of the older coffee planter who became over-burdened with advances and mortgages a few years ago seems to be no healthier, but new plantings are undertaken to-day with a very wary eye on likely total capital expenditure. Development is now proceeding within the actual means of the farmer, be he native or non-native.

The tobacco industry is progressing quietly, but the tobacco factory in Dar es Salaam still has to import a fair quantity of raw tobacco. Attention is drawn to the four-fold increase in the value of manufactured tobacco leaving the Territory. There must be an equally large displacement of outside manufactured tobacco from the local market.

The local trade engendered by the increase in activity in the mining areas, referred to in the report for 1932, is showing a steady increase, and remote districts like Ufipa near Lake Tanganyika are benefitting considerably. Apart from that, however, the influence of mining on general trade in Tabora is becoming felt, and one has not to look beyond Southern Rhodesia to realize the very great benefits which mining activity confers on agricultural enterprise. We confidently anticipate that mining activity will have an increasingly beneficial effect in developing the Iringa and Western Provinces, Singida and Musoma-Mwanza.

A ginnery site was granted in Mikindani Township to the owner of the Lindi Province ginneries in order that the Mikindani cotton crop, which hitherto had been brought by sea to Lindi and then by road to Mtua, might be more economically handled on the spot. Apart from that no change in the numbers of ginneries is to be recorded. We are more readily acceding to requests made by ginnery owners to install oil mills alongside existing ginneries, in order that the power plant may be economically utilized throughout the year and the engineer retained. This has the effect of keeping a ginner's representative on the spot throughout the year, which it is considered influences native cotton production favourably.

Heavy yields of lint were secured from land under irrigation at Arusha Chini, near Moshi, and developments are expected in that area in connection with the cotton crop. Non-native production of cotton shows some increase,

and more interest is being evinced. Planters are realizing that they must adjust their expectations of profit and their methods of cultivation to low price conditions; and areas are being developed from this point of view.

No development of note is to be recorded in connection with the possible citrus industry, but there is an inclination to regard the cultivation of citrus as one of the possibilities and enquiries are now being dealt with. The Bombay market appears worthy of development and supplies could well be drawn from the Tanga Province in due course.

The development of a sugar-producing industry is almost suspended, ample supplies may be secured from Kenya and Uganda, and the importation of essential sugar machinery from outside East Africa is controlled.

Regarding tea, a small development continues; there seems to be no additional enterprise in connection with this crop.

A survey of the cashewnut trees growing on the coast was made, and at the close of the year the grant of a licence to a factory owner to treat all cashew produced in Dar es Salaam District and Mafia was under consideration.

A planters' group for the production and bulk shipment of Madagascar butter beans was formed on Mount Kilimanjaro, but the heavy fall in the market values of pulse crops, almost 40 per cent., was not conducive to profit.

A growing industry of value to the Territory is found in beeswax production. It is the endeavour of the department to alter the system, whereby instead of a native being a "collector" of beeswax, he will become a "producer" of wax, maintaining a larger number of hives under his own supervision, and applying methods for the winning of wax which do not result in the destruction of bee colonies. Further enquiries regarding the market for this expanding export have been made, and it is intended to effect an improvement in the sorting, cleaning and packing of wax for the export market. This Territory should easily meet all Empire requirements for wax, a trade worth well over £100,000 per annum. Our wax exports were worth over £50,000 in 1933.

Demonstration work with cover cropping, terracing and the several other methods of checking erosion continues and is having an effect. During the year a number of Native Authorities passed rules which make it necessary that new native coffee plantings be done on contour, on land which is suitable, and with safeguards against soil erosion.

Late planting of all crops will be less noticeable after the season just experienced, when those natives who were late with their cultural work, suffered severe crop losses.

CROP ESTIMATES.

In the past various estimates of crops were compiled, some by Provincial Commissioners, some by the Traffic Department of the Railways and others by this department. There was considerable overlapping and the estimates in question were often inaccurate. In order to overcome this difficulty arrangements have been made for estimates to be issued by this department only, on information obtained from the Provincial Administration and officers of this department. In order that officers may have up-to-date information and check the tonnage export from their areas, monthly statistics are furnished to them by this office of all movements both locally and for export over the railways and through the ports. This information is furnished to this office by the

Customs and Railways and collated according to Provinces. As reports are received in this office of estimates of future production, these are collated and circulated and information is furnished to the Railways as to the expected tonnage likely to be moved at various points on the line. That the reports issued have proved fairly reliable in 1933 the following comparison will show :—

	Sisal Tons		Coffee Tons		Cotton Lint		Groundnuts		Beeswax		Gum
Estimate issued on 1st April, 1933, crops surplus for export ...	67,200	...	12,173	...	5,744	...	21,234	...	542	...	1,000
Actual export for 1933 ...	69,600	...	12,718	...	5,075	...	19,177	...	680	...	1,015

It must be understood that the estimates are not arrived at after careful statistical treatment, and therefore they cannot be expected to show greater accuracy.

MARKETING.

This is a matter on which conflicting opinions are held, generally influenced by the interests of those expressing the opinions. With cash crops other than cotton, marketing systems have been applied chiefly in the Lake Province, where in 1933 three methods were tried, in order to arrive at the simplest and most flexible system. The system of marketing is determined by the Administration on advice, and is an administrative measure primarily to effect sales for cash and to secure fair market prices to the producer. Agriculturally it enables the department to supervise and examine the produce coming in, and to point out to the cultivator his shortcomings. It is applied usually to *one or two major crops* only. Native people having had experience of selling cotton through an organized market, which is under close supervision, where prices are prominently displayed and where they can check and weigh their parcels of produce, were anxious that some similar system be applied to other bulk produce. If it is possible to apply and organize marketing to serve the bulk of a population in a province, then the system will be demanded, and it is really only one step towards co-operative marketing, which would have been demanded prematurely, had not a marketing system been applied.

As a means towards increased production, the personal satisfaction of the individual grower with the conditions under which he sells his produce, is surely a most potent factor.

The marketing of cotton during the year also has undergone a process of evolution, and it has been possible to assure the grower that he will receive what is practically a fair market price for all qualities of the cotton he produces.

The Native marketing group, mentioned in my last report, has shown signs of developing but it is felt that prematurely to encourage such group methods would result in a set-back, as it is not possible yet to counter all the influences, which would tend to disrupt a marketing group. The matter, however, is not in abeyance, and it is under review from time to time.

The Kilimanjaro Native Co-operative Union is a relatively highly developed co-operative effort, dealing with a volume of produce of considerable value. It is unfortunate for the cause of native co-operation that this is the only example as it is too complex a system to follow at one leap.

The situation in Bukoba is interesting in that by means of the grading rules we supervise the produce as it leaves the merchants' hands for export, and with Native Authority rules we supervise the production and preparation of the coffee by the grower. In between, the country marketing organization remains unaffected, traders being particularly emphatic that this should be left alone. In many instances the composition of the coffee changes for the worse during the process of collection. Bukoba merchants apparently are not strong enough, or are not sufficiently united, to refuse to accept from their collectors, coffee which they must know has been mixed. The result is that practically all coffee has to undergo a process of cleaning to enable it to pass the fairly low standard set for F.A.Q. It is a known fact that coffee winnowings are taken out of the town of Bukoba to the country districts, where their use is a matter for some conjecture.

Notwithstanding this purely local and domestic manifestation, which will be checked by legislation, if merchants cannot unite to overcome it, Bukoba coffee for export has maintained its standard, and is now more largely dealt with under certificate.

AGRICULTURAL SHOWS.

A very extensive and highly successful Provincial Show was held in Mwanza during the year, and apart from its very great educative influence with the native population, gave merchants and visitors a better appreciation of the needs and spending capacity of the Lake Province population. Altogether it was a very fine effort on the part of the administrative and other officers, and full advantage of the opportunity for educative propaganda was taken by the department. As in former years, District Shows organized by the Administrative and Technical staffs in districts were held, and the experience gained with these smaller shows, both by the people and the staff, was fully utilized with the large and culminating event of the Trade and Agricultural Exhibition in Mwanza.

AGRICULTURAL EDUCATION (Training).

The department has been constantly training a small number of natives directly on experimental stations or farms to become native instructors, and in one or two districts has conducted ploughing schools; during the year considerable strides were made regarding agricultural training. A final and mutually satisfactory arrangement was come to during the year between the Departments of Education and of Agriculture as to the relative responsibility for native agricultural education (training). It remains to put the arrangement into practice, and this will proceed as opportunities present themselves. Briefly the Agricultural Department is charged with all agricultural training and the supervision of such agricultural education as is offered by the Department of Education at its Teachers' and other Educational Centres. The department is to continue to inspect and advise as regards school gardens.

During the early part of 1933 the Nyakato school at Bukoba was turned over to the department as a coffee training centre and placed in charge of Mr. Haarer, Agricultural Lecturer. The Administration and the Forestry and Veterinary Departments are all interested in and help with the work of this school, which shows promise of becoming a valuable instrument in the development of the Bukoba District. It should be noted that the venture is not exclusively agricultural (or agronomic) all departments concerned are contributing their meed of assistance, the department, however, administers and staffs the school.

Without much assistance or expenditure the department is developing another school in co-operation with the Native Authority. This is the tobacco station at Theme. Here natives are trained in the use of oxen, and in the cultivation of tobacco. At Lubaga, natives are trained as ploughmen. Similarly at Morogoro a few natives are being trained to use oxen which have been introduced on the station following the establishment of a herd of dairy cattle. Preparations are being made to train people as peasant farmers at Ukiriguru. Thus it may be gathered that whilst the development of agricultural training work for natives by the department has been spasmodic, yet there has been a steady drive towards an objective defined and by methods conceived some years ago.

These developments are naturally likely to become a drain on the numbers of the field staff of officers, who, if of the right type for this kind of work, bring to it a lively sense of the requirements of a native peasant, and they have considerable understanding of the native. This is all essential if the training is to proceed aright. A scheme is under consideration which will accelerate the activities of the department in this section of its work.

NATIVE DEVELOPMENT.

The large areas of this Territory which we know can be thrown open by reclamation properly directed, must first be opened up by means of the hoe, but their permanent and extensive occupation will, it is believed, be achieved, *inter alia*, by the development of small holdings ranging up to twenty acres, capable of supporting the family and its livestock in better shape than is now customary. Whilst the training and use of oxen and the keeping of cattle is undertaken by local natives on Native Authority farms, and many oxen are trained annually, this work will not be effective and permanent until we are in a position to train and put out a number of native peasant farmers. These must be trained on the large farms under supervision. Further, a new conception will have to be well demonstrated, and the youth of to-day will have to be drilled and trained into a system into which the youth a generation or two hence will be born. To us at present the fly problem, and reclamation, is a matter of the greater and more effective occupation of the land by the people, and little else.

The problem of thin scattered populations at possibly uneconomic distances from communications and therefore markets, is rendered simpler where sleeping sickness is prevalent or likely to arise. On account of the fact now recognized that the best natural counter to sleeping sickness is the concentration of enough population to make the bush they occupy untenable by fly, the need for concentration is easy to demonstrate. As populations concentrate it is easier to administer them and, as the produce is concentrated, the surplus of production immediately takes on a practical aspect.

It is anticipated that, as populations become concentrated and the settlement, after the first few hard years finds itself more virile and able to devote some of its time to the raising of suitable cash crops, districts, the population of which has hitherto been looked upon as too diffuse, will be well enough organized to contribute in increasing measure to their own prosperity and that of the Territory. As concentrations become wealthier they will attract more population and thus become centres from which people will face outwards to reclaim the bush land now denied to them.

It is uncertain whether the concentrations will take shape on the "Stad" system or as a patchwork of small holdings. In the first event the latter is the more likely, but in the older organized areas in this Territory infested with fly one finds an approximation to the stad system, where the people are socially inclined.

It appears certain that concentrations of several thousand families will achieve the best results, as in those settled areas it will be possible to introduce livestock with some degree of safety. The development of the Western Province and the more backward areas of the Lindi Province must progress as populations are concentrated in the better agricultural and watered areas in those provinces, a problem not absent from other provinces and there perhaps almost as pressing.

LOCAL PRODUCTION FOR LOCAL CONSUMPTION.

During 1933 an increased endeavour was undertaken to produce more of the essential foodstuffs locally. Apart from tea and tobacco, crops which are developing steadily, the growing of vegetables, potatoes, onions, peas, cabbages and so on by natives is becoming increasingly important in the hill country not too far from consuming centres. A small sum of money annually would go a very long way to effecting a vast improvement in the strain of poultry kept by natives in the Territory and mass breeding should be concentrated at first in one place with trained supervision.

IRRIGATION AND AGRICULTURAL WATER SUPPLIES.

This department in conjunction with Amani has studied the composition of the water used for irrigation in Arusha where salinity and alkalinity were indicated, and recommendations as to the division of the scanty supplies of water are vested in Water Boards, but little control and technical supervision is exercised over the use and waste of irrigation water by cultivators of every race. Soil washing leading to infertility is frequent, and in other places excessive irrigation is likely to damage otherwise fertile land. Furthermore, whilst native people in the higher reaches of streams can and do take out and lengthen water furrows, cultivators below who inhabit drier areas and who are more dependent on stream water than those above, are deprived of it. In addition the washing of coffee by means of silt laden water, due to uncontrolled slope flood irrigation in the higher reaches, is an unsatisfactory thing.

It has been suggested that no irrigation permit should be issued unless the water is used sparingly and on terraces, and the layout of the area to be irrigated is approved.

Water boring work is under the control of the Geological Department, and from time to time Farming Companies hire the machines. Native Authorities are slow to take advantage of this service, possibly because no guarantee of success can be given.

Dam-making is infrequent, much could be done by the use of dams in water conservation, and it would be of distinct advantage if some department could offer services in this connection. No doubt as mining develops, dam- and furrow-making will be conducted on approved engineering principles, and these examples will at least provoke interest.

Flood irrigation.—There is no flood irrigation work in the country although there are a number of sand or dry rivers from which flood water could be extracted to provide fodder for stock or grow food crops for people. Whilst swamp lands are only partially used it is perhaps unlikely that flood works

will be undertaken. The value of a simple flood weir and a pair of contour furrows down each side of the valley would become apparent, were experimental or demonstration works of this kind undertaken, especially in the Central Province and possibly in the Lake and Western Provinces.

PESTS AND DISEASES.

The invasion by *Locusta migratorioides* was still with us in the early part of 1933 mainly in the Western and Lake Provinces but it was of less intensity than heretofore, and comparatively little damage was done. The Red Locust however increased somewhat in the Southern areas and reinforced considerably by immense flying swarms from south of the Rovuma, towards the end of the year the species spread rapidly northwards. As the fliers were mature, laying took place in many areas and, at the end of December, it could be stated that every Province was either infested or seriously threatened. The vigour and size of this locust together with its longevity, render it perhaps a more serious pest than the Migratory Locust, at any rate the native population more gravely fears it. Preparations were in hand at the close of the year for a campaign of the same type as those which have served hitherto. A form of joint endeavour, and concerted reaction to this international pest remains to be evolved for the field control of the swarming phase of this scourge. Attention is called to the utility of the Polished Zinc Band, an evolution of the tinsheet and hessian barriers used in 1928 at Gilgil, Kenya. Expenditure, and the inability to guarantee any area immune from damage by the flying form, after all hoppers in the area have been destroyed, are factors which have to be taken into consideration with any locust campaign.

Rodents.—These pests were much less numerous in 1933 only one district, Mohoro in the Rufiji valley, reporting real damage. Poisoning was resorted to with some success. Animals like baboon and pig have done damage, not only to native plots, but on sisal estates near Pangani. The unusually droughty conditions and absence of open water, with possibly the exhaustion of natural food, have driven these animals to depredations which are much greater than usual.

Cotton has been unusually free from insect pests in most areas during the year. Pink Bollworm incidence was low in the coastal belt, due to some extent to the early maturing of the bulk of the crop. Staining remained high, however. Snails proved injurious to young coffee in Mbosi and were also a pest of sisal in the Lindi area.

Coffee pests showed little change, the situation on the whole being well in hand. The District Agricultural Officer (native) on Kilimanjaro initiated a campaign against the wild host plants of the white borer which resulted in the destruction of over one and three-quarter million wild hosts in the neighbourhood of coffee plots. In the process a huge number of borer grubs were killed. This work should have the effect of keeping the borer away from the plantations, and reducing the intensity of the pest.

The broad work on coffee root systems continued during the year, and it would appear that normal root distribution and development with coffee is very much a function of soil aeration, with all that that implies.

SCIENTIFIC WORK.

The purely scientific staff will be augmented when the Coffee Experimental Station is built and staffed. Meanwhile the Chemist (Mr. H. B. Stent) who

arrived in the Territory in October has been working at Amani. Of the three other scientific workers, viz. two Entomologists and one Mycologist, the Entomologist and the Mycologist were on leave during the year.

The Entomologist was posted in the Northern Province, his attention was concentrated on the White Borer pest and he successfully demonstrated, on some scale, that plantations could be kept fairly free of that pest, and that reinfection came from the bush. He made a number of observations on the Borer.

Leaf Miner will have to be further studied, as it is considered possible by the use of a combined spray and by spraying undertaken by blocks or groups of planters simultaneously, that several pests and diseases, including Leaf Miner, may be combatted by one or more sprayings with a combination spray at a certain time.

The Assistant Entomologist was stationed at Morogoro on his return from leave and devoted his time to bees and beeswax, cotton pests, and also undertook a safari of six weeks duration in a suspected permanent breeding area of the Red Locust in the region of Lake Rukwa and in Ufipa.

The Mycologist was on leave from June to December. In the early part of the year he visited Mwanza, Mafia and Mikesse. He continued his work on Sorghum Smut, and observations on numerous diseases from some other plants will be found in his report.

EXPERIMENT STATIONS.

REPORTS FROM THESE STATIONS ARE ATTACHED.

Eastern Province, Morogoro.—The development of this station as a general or mixed farming and fruit experiment station continued during the year. The dairy herd mentioned in the last report is properly housed and there is a dipping tank on the farm. At long last a steady and pure fresh milk supply totalling about seven gallons per day is available for a portion of the residents of Morogoro, children and the sick, and is sold on the farm at approximately two shillings and sixpence per gallon. There is still a pure milk shortage in Morogoro, and it is hoped that local farmers will develop their dairy herds, feed them and protect them and handle the milk following the example set on the farm. Some yearling grade bulls have been sold to Missions and local farmers. The projected pig and poultry sections, it is hoped, will assist in improving local stock.

The very old citrus area has been thinned down to one-fifth its former area and is now three acres in extent, and new plantings have been made on an experimental scale to admit of proper comparisons being drawn. The local production of citrus fruit is of very small dimensions indeed. Undoubtedly, after careful investigation of suitable stocks and varieties, a citrus industry could be established in the district, to serve the Central Line at least.

Nursery work, the raising of citrus and other fruit trees, ornamentals and so forth, has been developed and the public is purchasing considerable quantities at rates published in the *Gazette*. The volume of orders and their value shows that this service was needed, and in the absence of private enterprise, it was the duty of the department to provide a source of supply and obviate the excessive and expensive importation of plants from elsewhere, with the attendant small risk of introducing new pests.

Some years must elapse before private enterprise will be of sufficiently great dimensions to render these services unnecessary, and there will still

remain the need for Native Authorities to support what is at present partially their own venture.

The main work of the station is with cotton, and a considerable area is devoted to selection and local work with varieties of this crop. We have some very promising strains which will undergo further trial. Selection work with cotton is carried out yearly, as no doubt there is ample scope for deterioration in such an artificial plant, which may be combatted by reselection and regeneration.

Sorghum varieties have been tested and a large discard made. This crop is the main cereal food of native people in the Eastern Province and it admits of much improvement from various points of view.

Cassava, too, an important food crop, requires regeneration to overcome what is called mosaic. After trial we are forced to conclude that seedling varieties are the only possible hope.

With sisal a cultural trial and a variety trial is under way.

Other crops grown are pulse crops and fodder crops.

The technique of coffee budding and grafting is being studied with considerable success by the Senior Agricultural Assistant whose report is attached. (See Annexure VI.) Briefly, now that we have evolved a technique for both budding and grafting which is over 90 per cent. successful, the application of this to commercial work must be studied. Whilst approach grafting with seedlings will give seedling arabica another kind of rootstock, what we desire is to graft from several arabica trees of known capacity and uniformity of berry on to a suitable rootstock which must be derived from seed. Thus it is hoped to secure greater uniformity of crop than where approach grafting from seedlings is the method used.

We need, however, to study the rootstock effect, if any, on the size, liquor and general quality of the berry borne on the grafted trees.

Hand in hand with this work must go the careful selection of healthy mother trees whose average capacity has been determined. It is noteworthy that the scions of arabica on Excelsa at Morogoro, although a year old, have not yet developed leaf spot or the diseases common on the ordinary arabica mother trees on the farm.

There is in the above a very important and interesting line of work for the Coffee Experimental Research Station.

Lake Province.—(a) Ukiriguru Station and Mwanza Rice Garden. The work of this station is taking shape, and the experimental work carried out is good, as reference to the report will show. The trials in every case refer to some practical aspect of near lake shore and lake shore agriculture. Selection work of value is being undertaken. An attempt was made to add a large adjoining area to this station for multiplication work and training in peasant farming, but the density of population was too great and an extension area is being sought in a less populous, but comparable locality not too far away from the station.

(b) Lubaga, due to a variety of causes, the possibility of which is never too far away from an experiment station in a semi-arid area, including the sickness of the officer in charge at a critical time, has yielded little satisfactory information during the year, but it has continued to discharge its present main function and that is to maintain a pure "U4" seed supply, selection of cotton too was carried out. As the department is staffed at present it is not possible to organize so completely as to be able to meet every contingency.

We have insufficient funds to prosecute very important practical work, namely the training and evolution of a class of peasant farmer, who will ultimately occupy and develop the large areas of country contiguous to Old Shinyanga (Reclamation and Tsetse Station) near Lubaga:

Iringa Province, Iheme.—This station which is part of the large farm set aside for a Native Authority training farm, deals mainly with tobacco, but will develop into a general agricultural centre. Up to date a considerable amount of development work has been carried out at a very low cost. A ploughing school is operated there, and natives are trained in tobacco culture, whilst the influence of Iheme is spread to other educational activities in the district, especially the Malangali school in the south and Tossamaganga Mission. At Iheme we must cater for both planter and native activities, and as in the Lake Province develop peasant agriculture. There is ample land in the Province for a much larger population.

A Tobacco Flue Barn has been built as it is anticipated that fire curing on estates will have to develop into flue curing to attain to a more saleable type of tobacco. The experimental work carried out to date is very restricted in scope, and the officer in charge, who is a tobacco expert, is by means of a grant from the Carnegie Corporation now taking study leave in Kentucky where he will be able to glean the latest information regarding experimental methods, tobacco types and handling.

Mpapura and Mpanganya.—For all practical purposes these stations are closed down, but an Agricultural Assistant resides at each one and works in the district.

The Coffee Experimental Station: Lyamungu, Moshi.—This property, some three hundred acres in extent was acquired during the year, and its layout has commenced. Clearing, contouring and cover cropping of small areas destined to become experimental blocks if approved, has been carried out, a nursery has been established and a number of grafted and budded coffee plants have been sent up from Morogoro. Planting material of other kinds has been forwarded, and material is being prepared at Lushoto and at Morogoro, for planting out there in due course. Building operations will commence early in 1934.

Sisal Experimental Station.—The establishment of this station on the Tanga Plain has come appreciably nearer.

VISITORS.

There were but few visitors during the year, with the restricted train service which also adversely affects our postal service, Morogoro is comparatively inaccessible to those who have but little leisure.

PUBLICATIONS.

The following Pamphlets and Leaflets were published by the department during 1933 :—

Pamphlet No. 9.—“Arabica Coffee: Periods of Seasonal Growth,” by A. J. Wakefield.

Pamphlet No. 10.—“The Red Locust,” by W. V. Harris, Acting Entomologist.

Pamphlet No. 11.—“Virginia Tobacco. Fire Cured Type. With special reference to the Southern Highlands of Tanganyika Territory,” by C. J. McGregor.

Mycological Leaflet No. 13.—“A Bark disease of Coffee,” by Dr. G. B. Wallace.

Mycological Leaflet No. 14.—“Asili ya Magonjwa ya Mimea ya Vyakula vya Wenyeji na namna ya kuyazuia kwake,” by Dr. G. B. Wallace.

Entomological Leaflet No. 12.—“Rats and Mice,” by the Assistant Entomologist.

Leaflet.—“Ukara Island and the Agricultural Practices of the Wakara,” by Messrs. D. Thornton and N. V. Rounce.

Leaflet.—“Compost Manufacture,” by F. R. Sanders, courtesy of the Director of Agriculture, Nyasaland.

Leaflet.—“Seed Cotton. How the Price is arrived at,” by E. Harrison.

The Cotton Advisory Board, the Coffee Advisory Board and the New Sisal Cess Board met when necessary during the year. It is desired to acknowledge the advice afforded by these bodies and to express appreciation of the public spirit and helpfulness of the various members.

Legislation was passed dealing with the Cotton Tax, the Coffee Cess and the Sisal Cess. There is a growing interchange of views between the three departments of Kenya, Uganda, and this Territory. Amani staff has travelled fairly extensively with various District Agricultural Officers, no doubt with benefit which is mutual. It is hoped that the department will soon be in a position to make greater strides in co-operation with Amani, the projected Coffee and Sisal Stations will afford more opportunities for joint work, which hitherto has had to be improvised. In October the Heads of the Veterinary, Forestry and this Department conferred with the object of further co-operating in district work and obviating any possibility of conflicting advice being tendered in districts. In short it was found that the instructions issued by this department in 1931 regarding team work had been developed, and it is intended to make this take further shape in the future. It was agreed that quarterly consultations would be of value, and a complete interchange of general advice to field staff would be advisable. When possible, as considerable travelling is involved, the Director attends either as chairman or member meetings of the following boards and committees:—The Coffee Board, Moshi; the Sisal Board, Tanga; the Cotton Board, Dar es Salaam and Mwanza; the Economic Advisory Board; the Railway Advisory Board; Soil Erosion Committee; Sleeping Sickness Committee and the Dar es Salaam Chamber of Commerce.

The organization of the department has remained unaltered, but continuous economy and retrenchment, coupled with the comparative isolation of Headquarters, and the extensive nature of the Territory, throws a heavy burden on a department which is still endeavouring to render full service and to develop its activities notwithstanding the restrictions imposed by the Territorial budget.

The staff of the department in co-operation with their fellow officers has accomplished a very great deal of work, and the records of the periods spent in the field in vital work in contact with the cultivator are very good indeed. Great pleasure was given to the staff when Mr. B. J. Hartley was awarded the M.B.E. for outstanding field work in co-operation with his brother officers in Maswa.

Mr. A. J. Wakefield carried out the duties of Acting Director with marked ability.

It is again desired to record thanks for the enthusiastic assistance rendered by many officers in the Administration and other departments and to note that

the cause of agricultural progress has so many supporters. Particularly would one like to thank the Secretary for Native Affairs and the Provincial Commissioners, Lake and Western Provinces, for unvarying help both practically and in discussions.

NOTES ON CHIEF EXPORT CROPS.

COTTON.

Attention is drawn to the remarks under this head in the report for 1932, dealing with the cotton cess, motor transport and marketing. Towards the end of 1932 and early in 1933 the situation in regard to cotton generally was reviewed by the Cotton Advisory Board and a meeting was held in Dar es Salaam at which those interested in the industry were able to expound their views to the members of the Cotton Board. Thereafter certain action was taken, and the rules were amended to suit a policy evolved to meet some of the disabilities under which cotton growers, ginners and the department seemed to labour. The cotton buyer was anxious that no alteration should be made, except such as would confirm his interest. As all cotton store leases are due to lapse within a short period of years the attitude was understandable.

Briefly action was taken to prevent the mixing of seed by movement of seed cotton from district to district, to curtail the excessive transport of seed cotton within and without the district in which it was grown; to give the established ginner a greater responsibility for the promotion of the crop in his zone, or where zoning was not applied, in his district; to secure adequate amounts of good cotton seed free of charge, and its transport to distributing points at the expense of the ginner; to safeguard growers against excessive ginning charges; to reduce the amount of tax taken as cotton cess; and by means of a fair price scale and supervision and check weighing, to protect the native grower against unfairly low returns and to rectify the customary disparity in values between Nos. 1, 2 and 3 native cotton and between No. 1 native high grade and bulk crop cotton grown by non-natives and the larger native growers. It was also intimated that no *new* ginneries could be erected until the size of the crop warranted such action, but old ginneries may be resited.

By means of agreement amongst buyers and ginners in parts of the Eastern Province, the buying organization was very much simplified and reduced, but all store owners shared in the proceeds of the buying commission allowed on native seed cotton. Thus the possession of a store valued at say £300, after all expenses had been paid yielded about £100 to the fortunate owner, in some cases without his having had to leave his office wherever that may be. It is noteworthy that many cotton buyers now have an interest in or an agreement with a ginnery.

Analysis of the approximate distribution of the proceeds of one bale of lint from No. 1 native seed cotton from Tanganyika is as follows:—

One bale of lint = 400lb.
 = 1,300lb. seed cotton.
 = 600kg. seed cotton.

Say full value 6d. per pound of No. 1 lint delivered four months after purchase of seed cotton to spot Liverpool.

6d. is a compound of Liverpool futures and Liverpool premium;
 say $4.75 + 1.25 = 6$ pence.

Return to Grower at Ginnery		Buyer's Commission		Ginning Fees		Cost of Railage agency. C.I.F. to Spot. Freight and Overheads			Margin to Merchant
95/-	...	12/-	...	27/-	...	46/-	...	20/-	= 200/-

On a market indicating 6d. per pound for No. 1 Native East African, it is seen that the grower receives slightly less than half the value of the lint. The buyer receives an amount equal to about one-eighth the value to the grower and the merchant who runs some risk, takes approximately over one-fifth of the grower's value.

The ginning cost in a 1,200 bale ginnery is Shs. 27/- per bale. This includes site rent, licence, cost of running the ginnery, oil, wood, engine spares, upkeep and interest on capital at 5 per cent.

The Railage, Freight, and general realization at Shs. 46/- represents the average cost of moving one 400lb.-bale from the ginnery in Tanganyika to spot Liverpool.

The merchanting margin covers the ever attendant risk of having to carry and insure the crop after delivery at the market and covers falls in premium. In effect the grower receives the balance of value after the costs of buying, ginning and realization have been met.

The actual mechanism of the sliding scale is illustrated as follows:—

Take full price Liverpool middling four months futures in pence add full anticipated spot premium in pence, subtract one-tenth from the total to cover margin, then subtract the figure 2.50 representing buying and realization charges, divide the remainder by 18.2 for kilogram areas or by 40.0 for avoirdupois areas. The result is the value in cents per kilogram or pound respectively of seed cotton delivered at the ginnery. In promulgating prices the ginnery's position regarding transport is given consideration. The figure 2.50 should be reducible as ginnery outturns increase and more economical buying is practised and established. It is further to be noted that there is nothing to prevent any person paying more than the fair price, although we are assured that it would be difficult to do so except on a very fortunate speculative hedge.

The department is regularly advised of the futures and premium values, and promulgates fair prices for all grades of seed cotton once or twice weekly throughout the cotton season in all areas. This system has worked satisfactorily during 1933, and appears to have the merit of pleasing the native grower. It is unfortunate that prices have to be quoted to natives at so many cents per pound or per kilogram of seed cotton, some larger unit of weight would give a closer price. The fact that a price scale would be operated by the department in 1933 was communicated to all growers at planting time and an explanatory memorandum was issued.

It is gratifying to record that the export of cotton lint in 1933 constituted a record for the Territory, 5,075 tons being exported (equivalent to 28,419 bales) as against 4,947 tons in 1929. Actual production is estimated at 28,490 bales as compared with 18,039 bales actual in 1932. This increase in production of nearly 60 per cent. is particularly satisfactory in view of the fact that the short rains merged into the long, thus shortening the planting season and with consequent drought in many areas, especially the Pares and Handeni. In these latter areas cotton growing was so adversely affected that only about 28 per cent. of the previous year's production was attained.

Production in the Lake Province was nearly doubled, 15,000 bales being obtained as against 7,700 in the previous year. In this connection it must

be stated, however, that in 1932 the yield in the Lake Province was considerably reduced by adverse conditions, whereas in 1933 conditions there were generally more favourable than elsewhere in the Territory.

In the Eastern Province, the crop increased by 50 per cent. to 12,800 bales and here the increase would have been still greater had weather conditions been more favourable as planting areas were greatly extended.

In Lindi Province, where cotton production had languished, 41 bales only being produced in 1932, efforts were made to revive production with most satisfactory results, approximately 880 bales being obtained.

Estate production, which is confined practically to the Eastern Province, showed a revival and as foreshadowed in the 1932 report the planters increased their output considerably.

As this report is compiled prior to the completion of the season's ginning, it is not possible to give the completed figures for lint production, but in the following table approximate figures for 1933 are given based on the seed cotton production figures for the year, which are also included :—

Province	1930	Lint in Pounds		1933 *approx.	Seed Cotton in Pounds 1933
		1931	1932		
Eastern	5,291,182	1,566,834	3,405,945	5,138,560	16,576,080
Lake	3,437,289	2,804,488	3,098,877	5,687,353	18,346,336
Lindi	371,541	63,058	16,548	371,349	1,197,978
Tanga	68,500	67,765	322,216	127,658	411,844
Northern	‡52,650	‡37,613	372,316	70,928	228,866
†Bukoba	33,104	873	—	—	—
Total	9,254,266	4,540,631	7,215,902	11,395,848	36,761,104
Bales	23,135	11,351	18,039	28,490	

*Based on 31% extraction. †Now incorporated in Lake Province. ‡Includes a portion of Pares, Tanga Province, production.

Non-native production for 1933 is estimated at 3,250 bales (of 400lbs. each), about 11 per cent. of the total production as compared to 8 per cent. in 1932. In 1932, 1,229 bales only were produced and the increase recorded shows a renewed interest in the crop and, it is hoped, foreshadows a general improvement for the future.

The following are the figures of non-native production in the various areas :—

Kilosa District	...	...	...	...	1,858 bales.
Morogoro District	...	...	...	...	1,163 „
Lindi Province	...	...	...	...	67 „
Dar es Salaam and Bagamoyo Districts	...	...	...	...	65 „
Rufiji District	...	...	...	...	35 „
Kiberege District	...	...	...	...	34 „
Northern and Tanga Provinces	...	...	...	...	28 „

3,250 bales.

The sales of seed cotton by natives during the 1933 season are shown in the following table :—

Area	Seed Cotton (Native) in Pounds.				Value received by Grower
	1st	2nd	3rd	Total	
					Shs.
Morogoro	4,685,731	155,513	737,517	5,578,761	351,375
Kilosa	2,829,400	857,406	720,237	4,407,043	349,319
Rufiji	711,374	118,485	145,377	975,236	66,700
Bagamoyo	734,144	18,442	90,598	843,184	63,668
Dar es Salaam ...	376,695	16,139	89,672	482,506	39,579
Mahenge (Kiberege)	190,189	—	27,030	217,219	15,345
Total Eastern Province	9,527,533	1,165,985	1,810,431	12,503,949	885,986
Lindi Province ...	885,583	53,622	171,303	1,110,508	89,274
Northern Province } Tanga Province }	460,706	42,361	102,090	605,157	43,675
Lake Province ...	16,412,191	59,337	1,874,808	18,346,366	1,578,100

The range of prices paid in the various provinces shown in cents of a shilling per kilogram for seed cotton is given in the following table:—

	1st Quality			2nd Quality			3rd Quality	
	Max.	Min.		Max.	Min.		Max.	Min.
Eastern Province	22	16	...	17	12	...	13	7
Lake Province:								
Shinyanga (Usogore) ...	22	15	...	17	11	...	13	7
*Mwanza	24	17	...	—	—	...	9	8
Tanga Province	19	15	...	15	11	...	10	5
Northern Province	19	16	...	15	12	...	10	7

* First and third qualities only are purchased in the Lake Province, with the exception of Shinyanga.

The above prices were based on the promulgated prices on the fair scale, and in some instances are a cent above it. Attention is drawn to the range of prices of the qualities in 1932 when no fair scale was applied, showing the increased price relative to No. 1 obtained from the lower qualities, of which a specimen is given:—

25 : 18, 14 : 12, 7 : 5 and the average price of lint in 1932 was higher than in 1933.

SISAL.

The regular annual increase in production of sisal continues, 69,600 tons being exported in 1933 as compared with 60,554 tons in 1932. Prices improved early in the year but declined later, the average, however, for the year was somewhat better than in 1932, the value per ton F.O.B. being £12 13s. as compared with £11 10s.

The project for a sisal experiment and research station situate on the Tanga plain which had been in abeyance since 1931 has now been revived and it is hoped to start the station during 1934. The sisal planters associations of Kenya and Tanganyika have agreed to a coordinated programme which includes local and overseas research, the latter directed to the finding of new uses in Industry. The Tanganyika Sisal Planters' Association has unanimously agreed to the introduction of a cess on sisal to meet a proportion of the expenditure to be incurred and application has been made to the Colonial Development Fund Commissioners for additional assistance. The

question of the provision of funds by the Government is also under consideration. Legislation has been passed to enable a cess to be collected. The project includes setting up two boards, a local cess Board, and a Joint Board representing Kenya and Tanganyika interests, to deal with the allocation of finance and the general utilization of funds.

Plans are under consideration by commercial people for the establishment in the Territory of a factory or factories in which cloth, twine and rope may be made from sisal fibre.

The crop for 1933 was valued at £881,772.

The following are the figures showing production in the various areas for the last three years:—

	1931 Tons	1932 Tons	1933 Tons
Tanga Province	38,113	40,487	45,329
Morogoro-Kilosa-Dar es Salaam ...	9,866	11,052	13,964
Lindi-Mikindani	6,242	7,240	7,817
Northern Province	1,718	1,775	2,490
	55,939	60,554	69,600

COFFEE.

The coffee export for 1933 constitutes a record for the Territory, 12,718 tons having been exported as compared with 11,547 tons in 1930, the previous record. Although tonnage increased by 1,356 tons over 1932, values have fallen and the crop in 1933 was valued at £429,523 as compared with £463,597 in 1932.

The increase in production is particularly satisfactory in view of the fact that with the tendency to biennial bearing in the Northern Province, it was to be expected that output would show a reduction. The increase is largely due to the very good crop of Arabica coffee produced in Bukoba, 2,868 tons being exported in 1933 as compared to 1,401 in 1932. This is attributed mainly to the exceptionally heavy rainfall at the end of 1932, but it also reflects the value of the supervision and propaganda work which has been carried out with a view to resuscitating the native-owned Arabica trees, which, due to neglect, were steadily deteriorating. In the 1932 report attention was called to the dangerous position of the crop and the necessity for constant demonstration and advice together with the effective influence of the Native Authorities and the Administration. Considerable progress has since been made and an administrative officer was seconded for some months to co-operate with officers of the department in the work of influencing the natives to take more interest in the cultural side of the crop. A campaign for the thorough cleaning up of derelict plantations was carried out early in the year and later a pruning campaign. The work of regeneration will be continued in 1934, and the native is already becoming alive to the improvement which is being effected. As an example of the interest shown, it may be mentioned that 1,300 cheap pruning saws were imported for the work of regeneration. These were all sold to natives during the year and the demand for them was so great that it is proposed to order 3,000 more for 1934.

The campaign in question, however, can only be said at present to be arresting the decline and, with the poor rains at the end of 1933, the Arabica crop in 1934 will probably be smaller. The real results of regenerative work

should be noticed in terms of crop in 1935. Further comment on the position will be found under section 5 of this report dealing with the progress of cultivation in the various Provinces.

The Robusta or "Native" crop was up to standard though slightly less than in 1932, being 5,054 tons as compared with 5,705 in the previous year, which was a record crop. When it is remembered that the introduction of grading and inspection has reduced the net weight of exports by some 12 per cent., it may be gauged what the figures for the crops of these two years would have been under the old conditions of exporting coffee-cum-dirt and moisture.

It is a pleasure to record that the work of grading and inspection has progressed smoothly in Bukoba and there has been a marked co-operation between the exporters and the grader. This satisfactory state of affairs reflects great credit on the grader, Mr. T. S. Jervis, who has been responsible for the working of the grading section since its inception in 1932. Little direct business was done in Bukoba with overseas markets during the year, the crop mainly going to Mombasa for re-export. The interest shown by America in 1932 waned very considerably owing, principally, to Brazil C.I.F. prices being cheaper than anything Bukoba could offer. Whereas in 1932, 31,365 bags were shipped from Mombasa to America, 5,000 odd bags only were shipped in 1933. Consignments to London fell from 4,177 bags to 2,483 and to Continental countries from 9,004 bags in 1932 to 5,000 odd bags in 1933. On the other hand exports to the Red Sea ports increased from 15,890 bags to 32,007. These markets, however, are not interested in improved qualities, show little discrimination and therefore do not tend to encourage the grading up of the produce. Exports to South Africa and Canada increased each by 6,000 bags and local merchants are endeavouring to establish connections in those markets.

The following are the figures for grading and inspection at Bukoba for the year :—

No. of bags of 200lb.	Graded			Inspected		Total passed for Export
	G.A.Q.	F.A.Q.	Triage	Passed	Rejected	
Arabica	340	31,353	—	329	5,302	32,022
Robusta... ..	120	57,136	459	15	14,777	57,730
Total ...						89,752

In the Northern Province good crops were obtained and 4,775 tons of coffee was produced as compared with 4,107 tons in 1932. Of the crop 3,652 tons were estate production and 1,123 tons native production. A full report on the crop and conditions generally will be found in Annexure I, the report of the Senior Agricultural Officer, North-Eastern Circle.

In the Mbeya and Rungwe Districts the coffee grown is all of the Arabica type, and is mainly of non-native production. The following are the figures for the crop in 1933 :—

Rungwe area	...	...	39 tons.
Mbosi	,,	...	107 ,,
Mbeya	,,	...	40 ,,

Gratifying prices for the Mbosi coffee were received last season, and as experience continues to be gained in the problems of the area, the outlook for the future is hopeful. The Mbeya District has for some years held a high

place in the market for its produce and although yields are still low and erratic, treatment of the right kind should eventually have good effect. Rungwe District still appears to be a difficult district for plantation coffee and development has not advanced.

In the Mufindi, Dabaga and Lupembe areas the total production is estimated at six tons. The most promising area is that part of Lupembe known as Igololo, although the coffee there is later in coming into bearing than in most coffee areas.

The figures for production in the chief coffee areas in 1933 and the two previous years were :—

Area	1931 Cwts.	1932 Cwts.	1933 Cwts.
Bukoba	131,720	142,143	158,440
Northern Province	49,480	77,360	92,180
Usambara District	3,760	4,780	3,320
Iringa Province and other areas ...	—	2,957	* 3,840

* Estimated.

The total export and estimated values of estate and native coffee in 1931, 1932 and 1933 were as follows :—

	1931		1932		1933	
	Cwts.	£	Cwts.	£	Cwts.	£
Estate	41,320	81,269	63,097	159,213	73,460	165,285
Native	143,700	165,768	164,143	304,384	180,900	264,238
	<u>185,020</u>	<u>247,037</u>	<u>227,240</u>	<u>463,597</u>	<u>254,360</u>	<u>429,523</u>

TOBACCO.

Fire cured tobacco produced by natives in the Songea, Masasi and Biharamulo Districts continues to progress slowly but satisfactorily. Production in the Masasi and Songea Districts increased from 4,297 kgs. in 1932 to 9,548 kgs. in 1933. This crop requires considerable supervision and instruction and the purchase, conditioning, baling and marketing is done by this department. Commercial prices are paid for leaf, a margin being left to cover commercial costs when the crop passes out of control.

Production, though small, has definitely passed the experimental stage and a nucleus of trained growers has been formed. In Biharamulo progress has also been made, but the crop in 1933 was very small owing to the unfavourable weather conditions during the planting season. Had conditions been favourable the Biharamulo crop would probably have exceeded that of Songea and Masasi.

The estimated production of fire cured Virginia tobacco by non-native planters in Iringa increased from 44,000lb. in 1932 to 64,000lb. in 1933, all is marketed locally with the tobacco manufacturers in Dar es Salaam. Production is insufficient to meet local requirements and quantities of raw tobacco have to be imported from Uganda by the Dar es Salaam manufacturers. It will thus be seen that there is still plenty of room for increase in Iringa production. The quality of the material produced, however, is still very poor and considerably more attention is necessary in curing and grading if the crop is to progress satisfactorily. Advice and instruction is given by the officers of the Theme station and a pamphlet on the subject of fire cured tobacco has been issued for the use of planters.

The production of Turkish tobacco in Iringa shows no increase, approximately 7,000lb. being produced in 1933.

GROUNDNUTS.

The groundnut production for the year constituted a record, 19,177 tons being exported as compared to 18,684 tons in 1924, the previous highest export for the Territory. The prices realized were poor as compared with those of 1932, the average F.O.B. value per ton being £8 13s. as compared with £11 9s. The very satisfactory increased production of this crop is largely due to the efforts made in the Western and Lake Provinces which produced between them over 16,000 tons.

COPRA.

Copra exports, though not a record, showed a satisfactory increase over 1932 of nearly a thousand tons. As with most other commodities prices were lower than those of the previous year by approximately £1 per ton. The following table sets out the exports for the past three years:—

	1931 Tons		1932 Tons		1933 Tons
Tanga-Pangani	2,119	...	1,573	...	2,283
Mafia-Dar es Salaam-Bagamoyo-Rufiji ...	4,267	...	4,805	...	5,407
Kilwa-Lindi-Mikindani	488	...	887	...	467
	7,234	...	7,265	...	8,157

SESAME.

There was a slight decrease in the total production of this crop in the Territory, but the main production areas, Lindi-Mikindani-Kilwa showed an increase of nearly a thousand tons. Production is declining in the Western Province and other areas where the poor yields and low prices paid in comparison with groundnuts do not tend to encourage production. The export figures for the crop are as follows:—

	1931 Tons		1932 Tons		1933 Tons
Lindi Province ...	2,841	...	3,970	...	4,085
Lake Province ...	335	...	160	...	341
Other areas ...	649	...	681	...	15
	3,825	...	4,811	...	4,441

GRAINS.

The Territory exported 10,006 tons of rice, millet and maize valued at £75,607, a decrease over 1932 attributable to the fall in values of native grain crops, which in many areas make it unprofitable to transport the produce to the Coast. In Lindi the carry-over for 1934 is expected to be above normal as merchants there hold considerable stocks awaiting the chance of a favourable shipment.

The rice exports, however, show a very satisfactory increase and a record tonnage was exported. A considerable quantity is consumed locally and produce market returns show that 11,444 tons of paddy were marketed in the Lake

and Western Provinces alone. The following are the export figures for the three main grain crops :—

			1931 Tons		1932 Tons		1933 Tons
Rice ...	...	...	4,754	...	5,385	...	6,293
Millet ...	...	...	5,270	...	3,529	...	2,845
Maize ...	...	...	1,769	...	2,823	...	868
			11,793	...	11,737	...	10,006

OTHER CROPS AND PRODUCTS.

Beeswax.—Efforts have been made to encourage the collection of beeswax and to improve its preparation, with gratifying results. A record export of 680 tons was attained in 1933, the previous record being 607 tons in 1931. Prices were fairly well maintained for this commodity, there being only a slight fall in values. The general question of apiculture and collection of beeswax is dealt with more fully in the report of the Acting Entomologist, which forms an Annexure to this report.

Gums.—Exports of gums, Arabic and Copal, remained steady both in quantity and value. Of the 1,015 tons exported, 951 tons came from the Shinyanga District. The collection of gum in other suitable areas is worthy of attention. More attention might be given to sorting by the native collectors, as gum is graded according to colour, variety and cleanliness, at present a complete mixture is collected.

Castor Seed.—Samples of varieties of castor seed from the Bagamoyo District were satisfactorily reported on in England. The low prevailing price accounts for the fact that this commodity does not figure in the export returns.

Kapok.—Production shows an increase but prices are poor. 137 tons were exported from Tanga in 1933 as compared to 63 tons in 1932.

Citrus.—Further experimental consignments have been sent by this department to London and Bombay. The Bombay report was favourable, but no report has been received from London.

DETAILS OF ASSISTANCE AND PROGRESS.

NORTH-EASTERN CIRCLE.

Northern Province—Tanga Province.

The staff of this Circle consists of a Senior Agricultural Officer stationed at Moshi with five District Agricultural Officers, serving the Arusha, Moshi, Lushoto and Tanga areas, two Agricultural Assistants on Kilimanjaro, and one Agricultural Assistant supervising the initial layout of the Coffee Research Station. The Entomologist is also attached to this Circle and is stationed at Moshi. An Agricultural Chemist was appointed during the year for service with the Coffee Research Station, and pending the opening of the station, is posted to Amani.

Drought conditions prevailed to a greater or a lesser degree over the whole of the Northern and Tanga Provinces. The short rains of 1932 were late and extended into January, 1933. The long rains failed almost entirely in the Pare, Usambara and Handeni plains and rains in the mountain areas were

below normal. As a result of the drought and in spite of increased acreage under cultivation, there was a decrease in production of all annual crops, with the exception of rice. In Handeni, where the principal food crop is maize, only a 20-per cent. crop was harvested, with the result that serious famine conditions prevailed, necessitating Government relief measures. One good result, however, of the famine is the fact that it has brought home to the people the necessity for planting cassava as a famine crop, a measure urged by this department for the last two years. The District Agricultural Officer, Tanga, states:—

“The famine in Handeni has demonstrated the value of root crops particularly cassava, as being very much more drought-resistant and reliable than maize. Propaganda allied to an extreme shortage of food has now convinced these natives of the value of this crop. During the year about 900,000 cuttings were purchased for planting in prepared plots at the headquarters of the ‘Jumbes’. These plots will be increased in size next year and after harvesting there should be sufficient cuttings to enable every man in the district to own a plot. Natives carrying ten or twelve sticks of cassava in addition to their loads of food are a common sight on the Handeni roads. Some natives purchased sticks at two cents each.”

Normally the Northern Province and the Usambaras are able to supply the food requirements of the Tanga sisal estates and provide a surplus for export. In 1933, however, supplies had to be imported.

Fortunately, sisal and coffee generally were not adversely affected. Sisal exports increased by 12 per cent. and a record coffee crop was obtained in Arusha. In most areas the coffee has withstood the drought surprisingly well, ripening was very rapid but the size of the bean was adversely affected. An increase in copra exports is also recorded but the fall in price has rendered the maintenance of plantations very difficult.

The cotton crop, which had been so successfully resuscitated in 1932 in the Pares and Handeni, suffered a severe set-back. In spite of increased enthusiasm and larger acreage, the drought caused the Pare crop to be a complete failure and only 25 per cent. of the estimated Handeni crop was obtained.

The investigational side of the culture of the coffee tree has been continued by officers in the North-Eastern Circle. It will be recollected that in 1932, considerable interest was aroused by the publication of Pamphlets 7 and 8 by Messrs. Wakefield and Sanders wherein attention was drawn to the process of root development and the factors which affected it. A further Pamphlet, No. 9, by Mr. A. J. Wakefield, Senior Agricultural Officer, was published in 1933, giving further information regarding coffee culture and pest control in the light of the author's observations. It is hoped, when the Coffee Research Station is functioning, that a further investigation may be made of the theories advanced by Messrs. Wakefield and Sanders, which appear, from a practical point of view, to be sound.

An interesting development is the erection of a cordage factory near Tanga by the Tanganyika Cordage Co., Ltd., which is expected to operate in January, 1934. The annual capacity of the factory is estimated at 2,500 tons of raw sisal.

A more detailed account of the activities of the department and the general agricultural outlook of the Northern and Tanga Provinces will be found in the report of the Senior Agricultural Officer, which is printed as an Annexure to this report.

NORTH-WESTERN CIRCLE.

Lake Province — Western Province.

This Circle is extensive in area and fortunate in having a large and particularly industrious population. Thus it affords a very productive field for agricultural endeavour. The staff consists of a Senior Agricultural Officer, stationed in Mwanza, District Agricultural Officers in Bukoba, Mwanza, Maswa and Shinyanga of the Lake Province and two District Agricultural Officers in the Western Province. Agricultural Assistants are posted to Bugufi, Biharamulo District, Bukoba and Mwanza. The Agricultural Lecturer is stationed near Bukoba and is in charge of the Nyakato Agricultural Training Centre.

Generally weather conditions were more favourable in the Lake Province than elsewhere in the Territory. There was an abnormally dry spell in March and April which reduced the yields of groundnuts and food crops, but was beneficial to cotton as it checked the usual pests and diseases which, in normal years, seriously affect the crop.

The main centre of agricultural activity is the Ukiriguru Farm which, besides being a demonstration and experimental centre, serves as a training ground for the native agricultural staff and for the teaching of peasant farming. Attention is drawn to the report of the Senior Agricultural Officer, which forms an Annexure to this report, outlining the work being undertaken, in particular the figures given of time and costs of hand and plough cultivation by an average native farmer.

The Nyakato Agricultural Training Centre which was inaugurated early in the year has progressed most satisfactorily under the keen guidance of the Agricultural Lecturer, Mr. Haarer. Situated in the coffee growing area of the Bukoba District, the school aims at giving a general agricultural training with a bias towards coffee. The Veterinary and Forest officers are both co-operating with Mr. Haarer with a view to the co-ordination of teaching in regard to animal husbandry and afforestation and the assistance of the departments concerned is gratefully acknowledged.

In the Maswa District, where cotton was planted for the first time at the correct period most satisfactory results were attained, a crop of 4,267 bales being produced, averaging 203lb. of seed cotton per acre, an increase over the previous year of 223 per cent. In this connection the District Agricultural Officer, Mr. B. J. Hartley, M.B.E., states:—

“The attitude of the cultivator has altered with regard to cotton as a crop from which some value can be obtained. The planting of cotton in order to obtain cash to purchase cattle is a practice which is becoming more and more frequent, and it is known that the door to ‘Usabi’, or wealth in cattle, is open to any ‘Mhabi’ or poor man, who has the food and energy to cultivate a crop of cotton using free seed.”

In the same District trials have been made with light wooden ploughs of the Indian type, made of local wood and iron, and constructed by a native carpenter for a price of Shs. 4/50. This implement has been found to do useful work in scuffling dry soils for millet planting and ploughing fallows and lightly grassed land. Cultivators, who have seen the Ndeybo plough at work, are not keen to take up the wooden plough at Shs. 5/- but say that they would rather wait until they can afford the imported plough, which costs Shs. 68/- with gear complete.

In the Bukoba District efforts have been made to improve the culture of the native Arabica coffee crop and to regenerate the trees. An administrative officer was seconded to the department for a period to assist in the work of regeneration and the cleaning of derelict shambas, with most satisfactory results. The work of improvement is being carried on and the natives are beginning to show more interest in their trees. Mr. Savile, District Agricultural Officer, makes the following interesting comments on the problem in question :—

“The bulk of the coffee trees in the district—more especially the Arabica trees—were planted in a most haphazard manner. Seedlings and plants of all descriptions up to three feet in height were planted, frequently in totally inadequate pits. Malformed root systems and close planting have prevented the trees—Arabica trees in particular—from developing to anything like their full size and cropping capacity. Only the exceptionally good conditions of rainfall common to the district have enabled the trees to produce a crop at all. Where natives have taken the trouble to plant seedlings of the correct age in properly prepared pits and with due care in not damaging the root-systems the results are amazing. I have seen numerous examples of Arabica trees which are now some fifteen years old and have a spread of eighteen feet. The only cultural work carried out on these trees has been handling off of surplus suckers and yet the trees are still giving very large yields *every* year. In every instance enquiries have gone to prove that the satisfactory condition of these trees is due to care in planting—in addition to the fertility of the soil in question. The rapidity with which the majority of Arabica trees have become old and worn-out is undoubtedly due to bad planting. While regeneration of these trees will serve to renew their vitality, on a great many plantations replanting is the only real remedy. If owners of such plantations were to uproot a number of their almost useless trees each year and replant with healthy seedlings they would scarcely notice the reduction of crop and after three years they would be actually increasing their crop. Old, but well-planted, trees will undoubtedly repay any regenerative work carried out on them. A combination of replanting and regeneration would lead to a very great increase in coffee exports.

“(ii) Too close planting, with resultant die-back and biennial bearing, causes a serious reduction in crop every year. The uprooting and replanting of all such plantations will be of enormous benefit to their owners.

“(iii) Coffee trees planted in the open are invariably far inferior to trees planted in the banana plantations. Such coffee plantations are unshaded, receive no soil mulch, suffer from wash and are rapidly decreasing in fertility. Such plantations ought to be uprooted or else thinned-out and interplanted with bananas. Regeneration or replanting are useless on such plantations without shelter and cover and a reduction of crop is bound to occur.

“(iv) Coffee trees grown under the best possible conditions will not last for ever and the necessity for replanting arises sooner or later. Thousands of trees in this district have reached or passed the stage when they ought to be uprooted. The sooner we get down to a thorough replanting campaign the sooner will we increase our exports. Furthermore if we delay much longer we will be faced with a decline in exports—more especially of Arabica coffee—which regeneration will only serve to delay but will not prevent.”

Production in the Western Province was most satisfactory, groundnuts and beeswax production rose well above the pre-depression level, the food position was good and there was considerable increased planting of cassava, that useful standby in times of food shortages. This satisfactory position reflects great credit on the Provincial Administration which spared no effort to improve the economic position of the Province. In addition to extended rice cultivation,

it has been decided to reintroduce cotton as an auxiliary crop to groundnuts and as a protection against reduction in that crop by diseases or weather influences. Mr. Linton, the District Agricultural Officer, Tabora, states:—

“The importance of reintroducing cotton as an already proven crop was discussed with the District Officers of Tabora, Nzega and Kahama who agreed to co-operate if a suitable scheme were laid before them. Two Chiefs in Nzega came forward and declared their willingness to work towards a revival of the crop and at a full baraza of Kahama Chiefs two agreed to make a start and a third came forward later. In consultation with the Senior Agricultural Officer it was decided to introduce the variety U/4/4/2 as being a more suitable crop for the conditions and to postpone a revival in Tabora until such time as the industry in Nzega and Kahama had become established.”

The cotton seed distribution was completed by December, 34 tons of seed being distributed among 11,000 people in the Kahama and Nzega Districts.

The cultivator has been advised how to plant and has taken the seed on his own initiative, thus there will be no regrets and the crop given the best chance to re-establish itself in as natural a manner as possible. Most excellent and enthusiastic support has been received from the Administration.

A fuller review of the activities of this Circle by the Senior Agricultural Officer will be found in an Annexure to this report.

SOUTH-EASTERN CIRCLE.

Lindi Province.

The staff of the Province consists of a Senior Agricultural Officer, stationed at Lindi, a District Agricultural Officer at Masasi and Agricultural Assistants at Songea and Mpapura. This Province has been much beset by difficulties in recent years, due to the fall in prices of grain crops, periodical famines and general poverty of the people. Efforts have been made to remedy matters by the encouragement of the planting of economic crops such as groundnuts, sesame, cotton and tobacco. Considerable success has been attained in 1933 and particular efforts are being made for the 1934 season. To this end three temporary European District Foremen have been engaged to assist both the Administration and this department in the general work of District improvement, famine prevention and other measures for the greater prosperity of the people.

In the coastal areas of Lindi, Mikindani and Kilwa the people are reasonably prosperous as they can dispose of their produce at the ports at fair prices. The hinterland districts, which can only be served by expensive motor transport or head portorage, are, of necessity, impoverished when prices for produce are low. For this reason the department has concentrated on the establishment of a native tobacco industry in Masasi and Songea. Progress in past years has been slow, but the initial spade work has been done and it can be said that the natives are now definitely interested and appreciate the high value of the crop to them. As in past years the marketing, baling, conditioning and oversight of the crop has been undertaken by the department.

As a result of the energy of Mr. R. D. Linton, who acted as Senior Agricultural Officer during the planting season, and the enthusiastic support of the District Officers, the cotton crop on the coast has been successfully resuscitated and production increased from 41 bales in 1932 to 880 bales in 1933. Considerable further extension is anticipated in 1934. The sesame crop showed a slight increase and the rice crop increased by 50 per cent.

A fuller account of the activities of the department in Lindi Province will be found in the report of the Senior Agricultural Officer, which forms an Annexure to this report.

Eastern Province.

The Eastern Province is one of the richest and most important Provinces in the Territory from an agricultural point of view. It is to be regretted that the existing staff of the department is insufficient to permit the posting of a Senior Agricultural Officer to co-ordinate the activities of the Province, which work has to be undertaken as far as possible by Headquarters. District Agricultural Officers are stationed at Dar es Salaam, Morogoro, Kilosa, Rufiji and, during the planting season, an additional officer to Kiberege. One District Agricultural Officer is also in charge of the Morogoro Experimental Station and an Agricultural Assistant is posted to Dar es Salaam to assist the District Agricultural Officer there with the work of the Bagamoyo District and the Dar es Salaam Botanic Gardens.

Generally the rains were poor, the short rains merging into the long and finishing early. In the coastal area these were followed by scorching sun which proved disastrous to food crops and famine conditions prevailed later in the year, particularly in Bagamoyo. Cotton fared better though yields were small, and in Bagamoyo practically no second pickings were obtained. Cotton, nevertheless, is popular with the people there and the failure of the food crops accentuated the value of cotton, for those who had it to sell were able to subsist on their own resources. Relief measures were undertaken from September onwards and supplies of sorghum were placed by Government at suitable centres. Supplies of seed and planting materials were furnished where needed. As, however, at the time of writing this report, the area is infested with the Red Locust it is likely that further distributions of seed and food will be necessary.

In Dar es Salaam District the native cotton crop, though still small, showed a substantial increase over 1932. The rice crop suffered badly from drought and yields were low. Non-native enterprise in Dar es Salaam is mainly concerned with sisal and copra. Despite the low price of sisal no estate stopped working and there has been a slight increase in the area planted. Copra prices have fallen so low that there is little margin for profit and planters have been obliged to seek alternative sources of income, notably cotton. There has been some improvement in the condition of the estates, but the quality of copra has not improved. Propaganda for the improvement of copra continues and two experimental drying kilns have been erected by the department in Dar es Salaam for demonstration purposes.

Mafia Island, which is almost entirely dependent on copra, shows some improvement in the degree of cleanliness of the plantations. The island was completely toured by the Mycologist and the Assistant Entomologist with a view to advising as to the best means of improving the condition of the coconut trees. Efforts have been made to find an alternative product for Mafia. Cloves have proved a failure and cinnamon is now being tried. Seedlings have been successfully raised and planted out for trial.

In the Rufiji District production of cotton and rice showed a decided increase and results were generally much more satisfactory than in 1932.

In Morogoro District, strenuous efforts were made to increase the production of cotton with satisfactory results. In spite of the adverse growing conditions an increase of nearly 60 per cent. over the previous season was

obtained. The lack of rain and consequent reduction in yield was somewhat compensated for by the very high percentage of clean cotton which was harvested. During the year there was increased activity on the sisal estates of the District, due largely to the price of sisal hardening and to the fact that several estates were nearing maturity. This activity was reflected by an increase in the tonnage of exports. Two new factories were constructed and several estates which had lain derelict were cleaned and cut.

There was an increase in planting of all grain crops, but yields were seriously affected by the adverse conditions and, with the exception of the mountain areas, the maize crop virtually failed. The food position however was satisfactory throughout the year.

In the Kilosa District, as elsewhere the rains were badly distributed with the result that much of the early maize was a failure and the millet crop was diminished. The cotton crop was most satisfactory, native production increasing by nearly 100 per cent. over 1932, in which year the production of 1931 was doubled. To achieve such a result with its concomitant reward in cash to the native peoples reflects great credit on the officers who have laboured in the district and in particular the District Officer, through whose energy and valuable co-operation so much has been done to increase prosperity in the Kilosa District. The revival in Kilosa was also marked by the return of faith in cotton by non-native planters, whose production also increased by nearly 100 per cent.

In the Kiberege Division of the Mahenge District efforts were made to increase cotton cultivation, but conditions were not propitious and considerable damage was done to the crop by game.

Iringa Province.

The Province is staffed by a District Agricultural Officer and Agricultural Assistant, stationed at the Theme Agricultural Station near Iringa and a District Agricultural Officer and Agricultural Assistant at Tukuyu.

Iringa and Njombe, in common with the rest of the Territory, suffered somewhat from the drought which prevailed during the year, but a sufficiency of food crops was reaped in the district, with the exception of Malangali, Luinda and Mdonya, where locusts had done considerable damage to the crops. In spite of the drought, however, the season for tobacco was, generally speaking, good. Coffee and wheat suffered a little, and the first small coffee crop in the district was less than was anticipated.

The Theme Station, which is primarily engaged in tobacco improvement and extension work, is now almost completed and includes a model tobacco flue-curing barn. In addition to work on tobacco, advice and assistance is given to planters in other crops and a section of the station is devoted to work on behalf of the Native Authorities. Fifty acres have been cleaned for this purpose and seed multiplication has been carried out with White Congo maize and Black-eyed Susan peas. A sub-station to serve the low-lying parts of the Iringa Province is maintained at Pawaga. Here multiplication of Faya rice is being carried out. Unyengwa rice has been tried, and though proved to be a heavy yielder, it has had to be abandoned as the grain is too soft for the primitive methods of husking employed by the natives. Work is also being carried on with White Congo maize, Virginia Bunch groundnuts and Kilinyali sorghum. A sample of Black-eyed Susan peas from Njombe has been well reported on and, as the natives are accustomed to growing peas and

this particular pea is a high yielder, it is considered that there is a field for the production of a profitable economic crop. Seed multiplication is therefore being carried out with this variety and trials are being made with four other varieties. Maize is the principal economic crop of the natives of Iringa and the market depends almost entirely on the Lupa Goldfields, where it is estimated that 300 tons were sold from the district. Rice production is increasing in the low-lying areas of Pawaga and Ulangu.

It is with European agriculture that the department's activities are mainly concerned in Iringa and in addition to tobacco, considerable attention has been devoted to tea and coffee. Assistance has been given wherever necessary in wheat, barley, nuts, deciduous fruits and a variety of other experimental crops. Apart from tea, there is only one established crop which Europeans can grow economically and that is tobacco. Almonds still show great promise, and since the inception of a flour mill at Dabaga, wheat and rye constitute small cash crops in a general mixed farming system. The production and marketing of tobacco is dealt with elsewhere in this report. A series of lectures on Virginia tobacco cultivation were commenced in 1932 and continued in 1933, articles were contributed to the German paper *Das Hochland* and pamphlets issued in English on the same subject. Turkish tobacco, with the cheaper and easier Virginia crop as an alternative, naturally does not find much favour. Production has not declined, however, and prices have been good, 10½d. to 1/7½d. per pound having been obtained in London.

In the Rungwe District the total rainfall was much below normal, the general distribution however showed no very marked alteration. There has been no pronounced effect on agriculture generally despite the shortfall in the total. The Mbosi and Mbeya Districts have shown their usual total and distribution, this regularity seems to be a feature of the area.

European production in these areas (i.e. south-western part of the Province) progresses satisfactorily. The production of tea has not altered materially but next year should see a notable increase in the acreage coming into bearing. The production of coffee has increased considerably, the increase being due to a considerable acreage in the Mbosi area bearing its first crop. The native coffee industry in Rungwe progresses slowly but satisfactorily. A greatly increased acreage under maize and beans has been developed as the result of the demand from the Lupa Goldfields, of which the natives have not been slow to take advantage.

Throughout the year tea has been manufactured on one estate in the Rungwe District. A factory has been erected at Mufindi, which will serve to manufacture the green leaf from all those gardens in the vicinity. Mr. Davies, District Agricultural Officer, states:—

"It is as completely up to date a tea factory as exists anywhere, in fact it is perhaps doubtful if so up to date a small factory does exist elsewhere. In view of so suitable an equipment and for other very important reasons the quality of the made tea will be awaited with the greatest interest and not a little anxiety. Owing to difficulties of finance very little development has taken place in the Rungwe District, one estate only has increased its acreage to any extent. In Mufindi development is on a much sounder footing and although no rapid increase is to be looked for a steady pace should be maintained, the exact amount depending mainly upon the price the tea will fetch. The pleasing feature of this area is, with few exceptions, the very high standard of excellence of the work in the field, it is most noticeable and speaks well for the future."

Free issues of local seed have been given to eight plantations in the Rungwe District and ten plantations in the Mufindi District. Unfortunately, the issue to the latter district was not attended with success. From the seed garden the crop came in very slowly and irregularly and, on keeping a few weeks pending a transportable amount, showed signs that it was quickly losing vitality. Finally the very cold conditions under which the seed was germinated were sufficient to cause heavy loss. This failure was a great disappointment. Under private enterprise 35 maunds of tea seed from India were imported early in the year and gave a very satisfactory germination.

Whilst coffee production in Mbeya and Mbosi proceeds fairly satisfactorily and should continue to succeed if up-to-date cultural methods are applied, the position in the Mufindi, Dabaga and Lupembe areas does not show the same promise. The Lupembe Central and Likangu areas, whilst they do not show so much promise as the Igololo area, can well be developed on a mixed farming system with coffee as a cash crop and, from this point of view, show promise. The Dabaga and Mufindi areas still show the same inadequacy of flowering as last year. Mr. Sanders, District Agricultural Officer, Moshi, visited the Province during the year and went exhaustively into the problems of the various areas and lines of investigation have been indicated.

Central Province.

Owing to retrenchment, it has been necessary to reduce the staff in this Province from two District Agricultural Officers to one and this officer is stationed at Singida, where it is considered he can best serve the Province.

There was great variation in the distribution of the rainfall throughout the Province. The precipitation in the Dodoma District was well under the average for that district, whereas Singida received more than its average rainfall, but this was due to abnormally heavy falls during January and early February. 371.3mm. fell from 1st January to 5th February, causing damage to crops through water-logging and encouraging heavy weed growth. Crops as a whole showed a distinct improvement when subsequently drier conditions prevailed.

The difficulties which face an agricultural officer in his efforts for betterment are envisaged in the following extract from the report of Mr. Curry, the District Agricultural Officer :—

“In previous reports it has been emphasized that the tribes in this area are in varying degrees mainly concerned with their livestock. They think in terms of cattle, and a man's prestige varies directly with the size of his herds. Agriculture is considered to be the women's work, and male interference in the management of the land is often resented. The conversion of the men to new ideas achieves little if when they return home, they are told to mind their own business.

“The present low cattle price is stimulating the production of economic crops. The sale of one good ox does not always bring in sufficient to pay the tax. This was an argument which was used with some effect last year, and it will, I think, still further influence production this year. But it is realized that this cannot be, and should not be a permanent reason for more and better agriculture. At the present time cattle are a drain on the fertility of the soil, and the benefits of increased production will be largely cancelled if it tends to conserve the large unproductive herds of cattle and goats. Only slowly are the women taking to the wearing of cloth, but there has undoubtedly been an advance in this respect during recent years. But still many natives seem to have very little use for money. There were several cases this year in the

Singida District of natives buying cattle with the money received from the sale of groundnuts."

Efforts are at present directed towards the introduction of a simple rotation into native agriculture, but the choice of crop is limited. The area under leguminous crops is small and the planting of cowpeas, beans and groundnuts is being encouraged. The introduction of Morogoro cowpeas into the Singida District proved a great success and this crop is becoming more popular with the natives each year.

Efforts to increase production were directed mainly to an increase in acreage under groundnuts. The tonnage marketed in Singida showed an increase of a little over 50 per cent., but it is considered that the actual production was much greater than the figures reveal. The natives were exhorted to retain ample seed for the 1934 planting and it is reported that this generally has been done. Further, owing to the fall in prices, there is a considerable surplus of unsold groundnuts remaining in the district.

In Dodoma there was a large increase in acreage under rice but the groundnut crop was disappointing, largely due to low rainfall.

Soil erosion is one of the main problems of the Central Province and practically all agricultural instruction necessarily becomes part of an anti-erosion campaign.

Demonstration plots illustrating contour drainage, the formation of contour drills and the digging of storm drains have been laid down, and efforts are being made to encourage natives to adopt a more permanent form of cultivation. To achieve this end a programme has been laid down which includes the development of animal husbandry by the use of crop residues as fodder and the full application of farmyard manure, rotation cropping, the demonstration of mechanical methods of preventing soil wash and sand erosion, the discouraging of cultivation on steep hillsides and the preservation of bush on the hillsides and steeper slopes.

MOROGORO,
20th February, 1934.

E. HARRISON,
Director of Agriculture.

ANNEXURE I.

ANNUAL REVIEW OF THE NORTH-EASTERN CIRCLE.

NORTHERN AND TANGA PROVINCES.

1. *Weather and Rainfall.*—Drought conditions have prevailed to a greater or lesser degree over the whole of the Northern and Tanga Provinces, and their influence on crop production is apparent throughout this report. The short rains of 1932 were late and extended into January, 1933. The long rains (April and May) failed almost entirely in the Pare, Usambara and Handeni plains, where there was practically a ten-months drought and in Moshi, Arusha and the Usambara mountains the rainfall was much below normal. Except on the coast the July-August planting rains also failed. Towards the end of November the drought broke and some rain fell in all districts, though again these rains were generally below normal except in the Usambaras. In most areas only 40 per cent. of the average rainfall was recorded during the year.

2. *General Remarks on Crop Production.*—As a result of the drought, and in spite of planting propaganda and increased areas under cultivation, a decrease in the production of all annual crops is recorded, with the single exception of rice. The vulnerability of Handeni as a low rainfall area dependent on maize as the principal food crop was proved beyond doubt; a 20-per cent. crop at most was harvested and from June onwards a serious food shortage developed, and the investigation of famine conditions has occupied much of the time of the District Agricultural Officer, Tanga. Up to the end of December approximately 250 tons of maize were distributed by Government in famine relief, and in addition large amounts were brought into the district for sale by traders. Many of the people left the district to buy or work for food on the coast or in the foothills of the Eastern Usambaras. In order to prevent the recurrence of these conditions the extensive planting of cassava has been organized and planting material distributed (as was recommended two years ago by this department), while the concentration of the people in the more fertile areas is under consideration. The cotton crop, though much reduced by drought, provided the means for the purchase of food by many of the people. Local food shortages were also reported from the Korogwe and Pare Districts. Normally sufficient maize is grown in Moshi, Arusha and Usambaras to supply the demand from sisal estates and to provide a small surplus for export, but this year 1,223 tons were imported. There was a large increase in the area planted to cassava in the Tanga and Pangani Districts, without which the food position would have been aggravated; the grain crops on the coast were poor.

3. A big effort was made to increase the production of cotton, two European Assistants and eighteen African Instructors were engaged temporarily over the planting season in the Pare and Handeni Districts and record acreages were prepared for planting. The Pare crop, however, was a complete failure, in many areas there was insufficient rain even for planting. The Handeni crop realized less than 25 per cent. of the original estimate. A record acreage was also sown to rice in the South Pares with the 1932 short rains. Being

an irrigated crop this was largely unaffected by drought and production was more than double that of last year. A further small increase in acreage is reported for the November, 1933, planting. The discouragement of crop failure and food shortage will need to be offset by a further effort if this setback is not to influence production during the coming season also. In the Pares rapid recovery is probable, but in Handeni it is more doubtful as conditions here have been serious enough to disorganize completely the normal sequence of planting.

4. The production of the principal export crops of the Circle, sisal and coffee, has been less obviously affected by the drought, and the railway and export tonnages for the Tanga Line show considerable increase, mainly due to sisal but in small part also to coffee and rice. Sisal exports show a 12-per cent. increase over 1932, all estates working to full capacity under the stimulus of higher prices, and replanting or extension has been carried out on a number of estates. The Arusha District (with Oldeani) produced a record coffee crop, and the Moshi and Usambara crops were well up to normal considering that it was the "off" season for Moshi. In most areas the coffee has withstood drought conditions surprisingly well. The possible effect of the drought on quality (as shown by prices) is difficult to assess in view of other market influences that have been operative, but ripening was very rapid and the size of the bean was adversely affected. Planting, except under irrigation and in high rainfall areas, has been brought to a standstill. With the fall in coffee prices advances obtained on crop have generally been sufficient only for maintenance and pest control, and although there has been some improvement in cultural methods extension in old-established areas has been limited. No improvements (such as the replanting of unproductive areas) requiring long term credit have been possible. Twenty-one farms were alienated in the Mbulu District. The export of kapok has doubled, and further extension of planting has taken place, in spite of the fall in price. An increase in copra exports is also recorded, though latterly the fall in price has rendered the maintenance of plantations very difficult.

5. No development has taken place in the Eastern Usambaras where there are fertile areas well suited to tea, cocoa and citrus, all of which require considerable capital outlay. A number of small trial plots of cocoa have been planted here by the department in order to determine the limits of successful cultivation of this crop.

6. The 1932 Annual Report for the North-Eastern Circle emphasized the vital importance of soil conservation to any permanent system of agriculture in the highlands which form a considerable part of the two provinces. Under pressure of population the native cultivator is rapidly approaching the stage where shifting cultivation with long term fallows is displaced by more continuous cultivation, and the adoption of measures for the prevention of soil wash is essential to the change over. The policy of extending demonstrations has been continued; under the Native Authority Coffee Rules new plantings are sanctioned only after precautions for the prevention of wash have been undertaken, and over 1,200 plots have been either terraced or contour-hedged on Kilimanjaro and in the Usambaras. This work is new to the native and is more easily introduced with a comparatively new crop like coffee; with food crops, where traditional methods of cultivation are followed, the conservatism of his womenfolk has to be overcome in addition to the natural apathy of the native, but in one locality on Kilimanjaro a large area of maize land has been

permanently contour-hedged under supervision, and demonstrations have been carried out in many other localities. The policing of rivers for the protection of water supplies has also been undertaken, and three hundred prosecutions instituted on account of infringement of the Native Authority Rules prohibiting cultivation within fifty yards of rivers or springs. Over-grazing, however, which is followed by loss of soil cover and soil erosion, is a more difficult problem. An unsuccessful attempt was made to introduce rotational grazing in one locality in the Usambaras, but even the increased carrying capacity of the land that would follow controlled grazing would not solve the problem. While the native regards cattle as the principal form of wealth instead of a source of profit requiring careful management, grazing will be stocked up to and beyond its full capacity, however that may be increased.

7. *Marketing*.—Cotton prices according to the Territorial scale were paid in the Pare, Usambara and Moshi Districts, the crop being purchased by the Moshi Trading Company, and ginned at Moshi. There were two series of markets in the Pares and Usambara, though the total crop (including Moshi) amounted to 69 tons of seed cotton only. The Moshi crop was purchased at Moshi and Himu. The projected removal of the ginnery to Membeni was postponed until next season on account of the failure of the Pare crop. The Handeni crop (162 tons) was purchased by the Kwashemshi Estate at scale prices less two cents per kilogram, the concession of two cents being made in view of long transport hauls in this scattered area. Two new buying centres (Kimbe and Mgera) brought the total to eleven. The Mzundu and Kwa Negero ginneries were closed and a new ginnery with improved equipment opened at Sindeni, all in the Handeni District and owned by the Kwashemshi Estate. Roads in this district were considerably improved during the course of famine relief work. The following prices were paid, in cents per kilogram of seed cotton :—

District	1st Quality		2nd Quality		3rd Quality	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
Handeni	19	15	15	11	10	5
Pare, Moshi, Usambara ...	19	16	15	12	10	7

8. The Moshi native coffee crop of 890 tons parchment (1933-34 crop to the end of December) was marketed by the Kilimanjaro Native Co-operative Union, Limited, on behalf of members of the twenty-three constituent societies. The coffee was bulked according to the four main groups of societies: Machame, Kibosho, Central and Eastern. No grading was attempted other than the usual strict inspection for dryness, but encouragement has been given to the keener growers to pool their coffee in lots of five tons or more for sale under a distinguishing mark. Provided a check is kept on the coffee marketed in this way this offers a premium on care in the preparation of crop.

9. Two auctions of parchment coffee were held at Moshi; at the first 105 tons were sold at Shs. 32/- per cwt. ex-godown, at the second all coffee was withdrawn from sale and shipped to London. One parcel of cleaned coffee was

offered in public auction at Nairobi but was withdrawn at Shs. 48/50. With the exception of the lower grades ex-cleaning works and of one parcel sold privately at Shs. 50/- per cwt., cleaned, all grades, the remainder of the crop has been shipped to London.

10. The Arusha native crop was sold by tender; Shs. 25/76 per cwt. parchment was realized for 85 tons and Shs. 22/40 for a further 15 tons. The Usambara native crop of 15 tons was mostly disposed of locally to traders, but one consignment was shipped to London, realizing Shs. 38/- to 48/- per cwt.

11. The bulk of the 500 tons Moshi native-grown onion crop was sold to local traders, ungraded, for export to Kenya, but 75 tons were marketed through the Kilimanjaro Native Co-operative Union, Limited, under inspection for soundness by Departmental African Instructors, and better prices were realized for these. Late in December the price rose from Shs. 11/50 per bag to Shs. 18/- as the result of short supplies from Bombay.

12. Following enquiries last season by a London firm several planters in the Moshi District were encouraged to plant Madagascar butter beans for export. An endeavour was made to form a co-operative marketing association, with compulsory grading of beans by the department, and several meetings were organized. Following the discouragement of a reduced acreage due to drought, however, and a fall in price from £17 10s. per ton c.i.f. London to £11, the scheme lapsed. Advice and assistance was given with the hand-picking of the beans, and finally 10 tons were disposed of to the local agent of a Kenya firm, for export, 10 tons were shipped on consignment to London, while approximately 40 tons remain unsold or have been sold ungraded for local consumption.

13. The Pare rice crop of over 700 tons was purchased by a local mill-owner and by small traders in approximately equal proportions. At the commencement of the season Shs. 18/- per bag was paid for rice locally but competition with Mwanza rice selling at Shs. 18/- in Tanga forced down the price to Shs. 14/- at which part of the crop remained unsold. Although cash is paid to the grower the marketing arrangements cannot be considered entirely satisfactory; a large proportion of the crop is partially cleaned by growers themselves before sale, and the appearance and quality of the product suffers in consequence.

14. The Usambara Farmers' Produce Association was formed last season for the marketing of mixed products, mainly vegetables and fruits, on the coast, but although reorganization has taken place difficulties in arranging cold storage accommodation have so far militated against co-operative marketing which is carried on as before by individual producers.

15. Two experimental consignments of oranges from Muheza were made up and despatched to London (20 cases) and Bombay (17 cases), under the supervision of the District Agricultural Officer, Tanga, and the Senior Agricultural Assistant, Morogoro. The oranges were Muheza seedlings, sized and graded for soundness and packed in standard cases ($12\frac{1}{2}'' \times 12\frac{1}{2}'' \times 25''$). These were despatched in cold store and were marketed through the normal channels. The Bombay consignment showed a little wastage on arrival, attributable to fruit-fly, but very good prices were realized. Eight cases sold at Shs. 25/50 each and nine at Shs. 24/75. The results of the consignment shipped to London are not yet available.

16. The marketing of the Muheza citrus crop is in the hands of local traders, and it is at present disposed of locally and to Kenya with the peak during July-

September and again in November-December. There are at present no exports (other than to Kenya) but these experimental consignments indicate a profitable alternative to the local market, for selected oranges.

17. Enquiries have also been received from trading concerns or planters regarding the disposal of the following miscellaneous products: cotton seed, cotton-seed soapstock, wheat, chillies, tea, coffee, pigeonpeas, cassava starch and medicinal products.

18. *Crops and Cultivation in Detail.—Sisal.*—The following are the exports over the last four years, in tons:—

Province	1930	1931	1932	1933
Tanga	36,480	38,113	40,487	45,329
Northern	1,659	1,718	1,775	2,490
TOTALS	38,139	39,831	42,262	47,819

The value of the 1933 exports is £554,059 as compared with £496,000 in 1932.

19. These amounts were shipped mainly through Tanga, as follows:—

Port	1930	1931	1932	1933
Tanga	37,728	39,552	41,686	47,140
Kilindini	411	279	576	679
TOTALS	38,139	39,831	42,262	47,819

20. Last year closed with the price for No. 1 sisal at £14 a ton. The price varied between £14 and £15 until May, 1933, when an improvement in market conditions took place, with a steady rise in price to £18 10s. in September. This was followed by a fall to £15 again towards the end of the year, which is attributable largely to dollar fluctuations and the relative cheapness of rope and twine grades of manila.

21. Exports show an increase of 12 per cent. over 1932, all estates working to the full capacity of available leaf. Costs of production having been adjusted so far as possible to a low price level the rise in price during the year gave the necessary confidence to undertake replanting on a number of estates, also to extensions of planting and to replacements in factory equipment where necessary. Estates in Arusha which were planted up just prior to the slump remain out of production. A rope and twine factory was erected near Tanga by one group of estates during the year.

22. The drought was scarcely felt on the coastal estates, but in the lower rainfall areas leaf growth, particularly of young plants, was retarded, and the sapless condition of the leaves rendered decortication difficult. Some estates reported a high proportion of discoloured fibre, and there were also occasional shortages of water for decortication.

23. There was an increase in damage caused by vermin, chiefly pig, which is ascribed to the drought. Sisal weevil (*Scyphophorus acupunctatus*) caused considerable loss on old-established estates due, probably, to the lower standard of field sanitation dictated by the necessity for reduced costs. "Banding disease" is on the increase on some of the older estates and manurial trials indicate that this condition may be associated with soil impoverishment, and that applications of potash and lime may prove economic under these conditions.

24. Plots for observations on the growth of sisal under varying conditions of cultivation (including cover crops and the application of nitrogenous

fertilizers) were established at Tanga and Mazinde (Lushoto District). Observations were carried out at Mazinde, though there was practically no growth whatsoever on account of drought. The Tanga plot had to be abandoned, and another site selected, on account of extensive damage by pig and sisal weevil. Similar observations were to have been undertaken at Moshi, but it was not possible to plant on account of the drought.

25. *Coffee*.—The following are the amounts of parchment coffee exported over the last four years in tons parchment, by districts:—

District	1930		1931		1932		1933	
Arusha (with Mbulu)	1,418	...	838	...	1,329	...	2,223	
Moshi	2,674	...	1,636	...	2,539	...	2,386	
Usambara	207	...	188	...	239	...	166	
TOTALS	4,299	...	2,662	...	4,107	...	4,775	

26. These amounts were shipped via Tanga or Kilindini as follows:—

Port	1930		1931		1932		1933	
Tanga	2,498	...	1,265	...	1,509	...	1,726	
Kilindini	1,801	...	1,397	...	2,598	...	3,049	
TOTALS	4,299	...	2,662	...	4,107	...	4,775	

27. The amounts of (A) estate and (B) native coffee produced for export over the past three years are as follows:—

District	1930			1931			1932			1933	
	(A)	(B)		(A)	(B)		(A)	(B)		(A)	(B)
Arusha	1,373	45	...	805	33	...	1,285	44	...	2,123	100
Moshi	1,918	756	...	1,073	563	...	1,506	1,033	...	1,378	1,008
Usambara	207	—	...	188	—	...	224	15	...	151	15
TOTALS	3,498	801	...	2,066	596	...	3,015	1,092	...	3,652	1,123
GRAND TOTALS	4,299	...		2,662	...		4,107	...		4,775	

28. The coffee year proper commenced with the short rains of 1932, which were late, but generally sufficient to bring out a good flowering. Unusual rains were experienced in January, but there were only light rains during May and June instead of the heavy continuous downpours usual at this time. While in the low rainfall areas the rains were definitely short, requiring the stripping of part of the crop to save the trees and the remainder of the crop, it appears that in the high rainfall areas these conditions were actually more favourable than the heavy rains normally experienced. Thus the District Agricultural Officer (Plantation), Moshi, reports:—

“Generally speaking in what is considered a normal year the rains of these months are excessive, a condition approaching water-logging occurs with consequent deleterious effect on the tree, particularly if a heavy crop is being borne, yellowing and dieback being the symptoms. During the year under review the rains of April, May and June were extraordinarily light compared with the average year and although on the lower slopes the rainfall was insufficient, on some of the higher estates the rainfall might be considered to have been nearer the ideal than is the case in the average or normal year; as a consequence the yellowing so prevalent during the very wet season of 1929-30 did not occur and there has been very little dieback. The inference to be drawn from this is that a system of drainage must be evolved particularly

on the heavy sodium clays of Kilimanjaro and also on the ash soils of Sanya."

Similarly the Moshi native crop, produced mainly at medium-high and high elevations, is 35 per cent. above estimate on account of these unexpectedly favourable conditions. In Arusha at the commencement of the season a big crop was expected, but the estimate was reduced by 40 per cent. in view of the failure of the rains. But in spite of the heavy loss of leaf the crop ripened up successfully and a record crop for the district was obtained, allowing for the inclusion of 200 tons from Oldeani, where many estates produced their first main crop this year. The District Agricultural Officer, Arusha, reports:—

"On the true deep ash soils west of Arusha much more crop was harvested than would have been the case if normally heavy rains in April and May had been experienced. The last occasion that this area carried a really big crop was in the heavy rainfall year of 1930 when losses of both crop and trees were enormous."

On the heavier Arusha soils (including Mondul) the effect of the drought was less fortunate, and where irrigation was not possible losses of crop occurred. In the Usambaras the rains were also much below normal and only a moderate crop was picked.

29. The crop was unusually early, and on some estates the ripening was so even and rapid as to tax factory space to the utmost. In the lower rainfall areas the size of the bean was reduced, and there was an increase in the percentage of "lights" and in loss in plant on cleaning. In view of uncertain market conditions it is difficult to trace the effect of the drought on liquoring quality by the reception of the coffee on the market, prices obtained, and reports, but the general opinion is that quality has suffered. The level of prices has been low, particularly for average and low qualities, but mainly as the result of exchange fluctuations.

30. In most areas coffee has been left in good condition for the next year's crop. As the result of January rains and the early cessation (and low total precipitation) of the April-May rains new growth came to early maturity, followed by the early appearance of spike. Some anxiety has been felt towards the end of the year on account of the poor rains in November and December, which were not favourable for a heavy setting. Planting, in almost all areas, has been reduced to a minimum.

31. The present financial condition of the industry is not favourable to the rapid adoption of new methods, and with a lower price level, advances are obtainable only when an early and certain return is seen. This hand-to-mouth policy is understandable, but it follows that little progress is made in cultural practice, particularly where results have not been clearly demonstrated. Some advances are recorded; a saner pruning programme, with the object of maintaining a good leaf area, has been generally adopted, but this required no outlay and costs less than the previous system of frequent pruning. Irrigation has been much resorted to this season, but greater attention as to time and method of application has been given. Cultivations have been less frequent and less drastic, possibly as the result of lack of funds, but it is nevertheless an advance in practice, though the envelope fork has made no progress except in the Usambaras where it has been generally adopted. Soil erosion still goes almost unregarded in the old-established areas while at Oldeani, where extensive new plantings provided an opportunity of planting on the right lines with due precautions against wash, advice given on this subject has not been put into

practice. Again the Usambaras provide the exception, where seven planters have terraced newly opened land. A number of planters in all districts have planted up small areas of cover crops for trial but the season has been most unfavourable, particularly for the slower growing cover crops such as *Dolichos hosei*. Little benefit from cover crops can be expected in the first season in any case, but in the low rainfall areas where quick growing cover crops such as black Mauritius bean were tried, there was at least the suspicion that the competition for moisture was affecting the coffee. In the Western Usambaras some large areas were planted to Gotani bean, which is now being replaced with *Desmodium scandens*, a very promising indigenous plant.

32. *Native Coffee*.—The work of the Kilimanjaro Native Co-operative Union, Ltd., in connection with the marketing of the native coffee has already been mentioned. Officials of the Union and of the small societies, are giving increasing assistance with cultural matters, particularly in the case of neglected or abandoned coffee and with pest control. The monthly meetings of the societies' secretaries with African instructors have been continued, and a number of meetings of individual societies have also been attended. Most of the societies now have permanent offices and stores for sprays and equipment, where regular meetings are held. It should be mentioned also that at one of these centres a hide shade-drying "banda" has been erected by the local society, encouraged by the Veterinary Department, and that others are being proceeded with. Under the new Native Authority Coffee Rules in the Moshi and Usambara Districts all new plantings have come under control, in order that haphazard and careless planting should be prevented. On Kilimanjaro 1,800 applications to plant were investigated, of which 600 were refused. Of the remainder nearly 1,000 plots were terraced or contour-hedged before planting was allowed. More than 200 unauthorized plantings and 750 badly kept nurseries were uprooted. In the Usambaras 30 plots and a number of nurseries were uprooted.

33. Similar Native Authority coffee rules as those in force on Kilimanjaro were adopted by the Arusha Native Authority towards the close of the year. Antestia spraying was successfully carried out by the Arusha native growers for the first time, with good results. A number of 1929-30 plantings coming into bearing, coinciding with good conditions at the higher elevations, resulted in a record crop of 130 tons.

34. *Pests and Disease*.—The excellent results achieved on several estates by the application of a Bordeaux spray for the control of *Hemileia vastatrix* (which causes heavy leaf fall) has convinced planters of the wisdom of maintenance of leafage by this means, and stocks have been laid in for the treatment of large areas of coffee. It is expected that the general adoption of Bordeaux spraying will result in a considerable increase in crop, and will tend to even out biennial bearing. Rains in January and February were favourable to the development of *Hemileia* and even those estates that gave the normal February-March spray suffered considerable leaf fall. It seems that areas that normally experience fairly heavy rains in December and January will have to include an earlier application also. It is not certain that the most economical strength or time of application of Bordeaux solution is known under local conditions, and these points are receiving attention. Leaf fall from leaf miner was less serious than in the previous season, but appeared to be on the increase towards the end of the year. It seems possible from results on some estates that the inclusion of nicotine in the routine Bordeaux spray will effect partial control of

leaf miner. This has not yet been tried out under controlled experimental conditions. Thrips was not serious early in the season, and although there were outbreaks on some estates after the early cessation of the long rains, these were not as widespread as was expected after such a dry season. White borer (*Anthonus leuconatus*) continues as one of the major pests. It is kept under control on most estates, but in ten cases of neglected estates orders have been given for the necessary work to be carried out. In the native coffee 8,190 trees have been uprooted or stumped and seven prosecutions undertaken, during the course of departmental inspections for borer. The identification of several indigenous small trees, or shrubs, as host plants of white borer, followed by an order that these should be uprooted, has resulted in most estates having been cleared of these. In the native areas, 1,800,000 of these small trees on Kilimanjaro and 120,000 on Meru (including Usa Forest Reserve) have been taken out, during the course of which over 113,000 grubs have been destroyed. The effect of this should be apparent in the decreased infestation of coffee next season. Block spraying for antestia with the arsenite of soda/sugar bait was undertaken early in the year, by estates and by the native growers' associations, but the unusual rains in January and February caused frequent interruptions.

35. *Experimental*.—Work was commenced on the Coffee Research Station at Machame, twelve miles from Moshi, early in the year. Twenty-six acres have been cleared and partly holed for planting early in 1934, eight acres of which are terraced. Nurseries of twenty-three varieties and selections of coffee have been planted, and also a wide selection of shade trees. The demonstration cover crop plots were transferred from Moshi to the station, but planting failed on account of drought. Plots for quantitative observations on soil wash under varying conditions have been laid out.

36. Observations on the Selian Estate (Arusha) plots have been continued by the District Agricultural Officer, Arusha. Shade (artificial) has been shown to control the yellowing of the leaves typical in this locality, and has increased yield. The coffee on the green manure blocks, in spite of thrips attack in the first season, is in better condition than clean cultivated coffee. Nitrogenous manures applied after the long rains are shown to assist ripening of the crop and to maintain the condition of the trees. In the time of pruning trials November-December pruning has given the best results.

37. Samples of parchment coffee from the Selian Estate manurial plots were submitted last season for liquoring report. No conclusions can be drawn from the results of one season's reports only, but there were indications that liquoring quality is improved by applications of potash. Samples from this season's crop have been submitted to brokers for report, and a duplicate set has been sent to the Imperial Institute for analysis. Samples were also submitted from fermented and unfermented lots of coffee from one picking on a Moshi estate. Reports on these support the results of previous seasons' tests, in that there appears to be no appreciable difference in liquoring quality or appearance between fermented coffee and coffee from which the saccharine matter has been removed by mechanical means. It seems probable from this that fermentation is only a convenient method of removing this saccharine matter, and that it cannot improve the inherent quality of the bean, which can, however, be adversely affected by over or under fermentation. Further samples have been submitted from the present season's crop.

38. Other observations on coffee have been made with the object of securing further data on the physiology of the coffee plant to supplement those presented

in Departmental Pamphlets 7, 8 and 9 published during the last two years. Thus samples of coffee wood taken at short intervals of time have been submitted to Amani for examination in order to determine the time at which flower buds are laid down. Observations on the periods of shoot and root growth have been continued and root systems have been examined on the block excavation method. Determinations of moisture content of soils at various depths, with and without cover crops, have also been made. Co-operative manurial trials on some Moshi estates have had to be abandoned in view of the impossibility of giving adequate time to the supervision of the plots.

39. *Tea*.—Thirty thousand pounds of made leaf were produced during the year, two estates only (in the Western Usambaras) being concerned. The District Agricultural Officer, Lushoto, reports that latterly the dry weather has caused the tea to go “banji”. Severe loss of bushes has been caused by *Armillaria* root disease, though a determined effort is being made to keep this under control and to improve soil conditions. There has been no further extension of plantings.

40. *Cocoa*.—Production from the one producing estate has been doubled over last season, exports amounting to nine tons valued at £50 per ton F.O.B. This estate is extending the area under this crop and field conditions have been much improved.

41. Samples from batches of cocoa prepared under varying conditions of fermentation and washing were submitted to a manufacturing firm, and a large trial consignment has been prepared on lines suggested by their report on these samples.

42. Small plots of Criollo seedlings were planted up in various localities in the Eastern Usambaras in order to determine the limits of suitable conditions, as there are comparatively large areas which appear to be well suited to this crop. Some of these plots had to be replanted during the short rains on account of losses from drought.

43. *Kapok*.—Exports have been more than doubled and there is considerable extension of planting in spite of the decline in price.

44. Saman scale, *Phenacoccus iceryoides*, appeared on an estate at Korogwe and on one estate in the Tanga District and was the cause of heavy defoliation and loss of crop. Two importations of predatory ladybirds were made from the Union of South Africa to combat this pest, but although a reduced infestation is reported from the Korogwe estate it is not yet possible to say whether the introductions have been successful.

45. *Copra*.—Exports over the last four years are as follows:—

				Tons		Value in Shs.
1930	...	...	...	3,580	...	1,320,420
1931	...	...	...	2,119	...	409,132
1932	...	...	...	1,573	...	284,029
1933	...	...	...	2,283	...	384,498

46. Production is confined to the coastal areas of the Tanga and Pangani Districts. Exports continue to be mainly to Zanzibar, and also to Mombasa. There are also exports of whole nuts to Mombasa and India. Prices dropped steadily throughout the year to a low record, yet despite this exports have increased by nearly 50 per cent. The District Agricultural Officer, Tanga, reports:—

“There has been no improvement in quality of copra nor in price inducement to initiate it. At the present Tanga price of one shilling per frasila

for average quality many growers will not pick their nuts; the price offering at Gombero approximately twenty miles distant from Tanga is as low as 40 and 50 cents per frasila. The local (Tanga) soap works continue to take a proportion of the crop."

47. Gummosis of coconuts is believed to be on the increase, and trial plots have been laid down near Tanga in order to observe the effect, if any, of fertilizer applications and of cultural conditions. The position with regard to rhinoceros beetle has improved in some areas as the result of clean-up campaigns conducted last year. Mr. L. F. Higgins, Agricultural Assistant, was transferred from Moshi to Tanga for two months of the present year, and carried out a similar campaign. Altogether 3,668 inspections were carried out under Coconut Regulations with 63 prosecutions and 50 convictions.

48. *Cotton*.—Sales of seed cotton by natives were as follows:—

1933-34 Season to 31st December, 1933.

District	1st Quality lbs.	2nd Quality lbs.	3rd Quality lbs.	Total	Value Shs.
Handeni ...	301,418	20,178	42,636	364,232	26,262
Pare ...	113,835	22,183	15,180	151,198	12,006
Moshi ...					
Usambara ...					
TOTALS ...	415,253	42,361	57,816	515,430	38,268
Carry-over from 1932-33 season				89,657	5,407
Total for 1933 (January to December)				605,087	43,675

There will be no carry-over of native seed cotton purchases to 1934.

49. Plantation cotton amounting to 98 tons of seed cotton was produced in the Moshi District, mainly under irrigation, one estate producing 82 tons from 100 acres. An extension of planting is anticipated next season.

50. The production of lint by ginneries (two only were operating this year) in the Tanga and Northern Provinces for the last four years is as follows:—

Province	1930 lbs.	1931 lbs.	1932 lbs.	1933 lbs.
Tanga ...	68,574	6,777	83,936	268,569
Northern ...	52,650	13,615	185,964	283,890
TOTALS ...	121,224	20,342	269,900	552,459

The 1933 figures include a carry-over from the 1932 season. It is estimated that the carry-over to 1934 will amount to 145,000lb.

51. The decrease in production in 1933 is entirely due to adverse climatic conditions. Following the great increase in 1932 plantings over 1931, a further increase in acreage took place in 1933, in Handeni by 28 per cent. to 9,000 acres, and in the Pares by 36 per cent. to over 8,000 acres. The attention given to care of plots was very satisfactory, but all effects were nullified by the drought. In central Handeni the failure was almost complete (only 23kg. were picked from a measured acre on the Handeni Native Authority Farm) though better crops in the more fortunate areas brought in total crop to 162 tons, compared with the original estimate of 800 tons. In the Pares the crop was a complete failure except for some irrigated plots, and only 69 tons were marketed, which included 28 tons from Korogwe and 10 tons from Moshi.

In the Pares a recovery is anticipated in 1934, given good rains, as very little work on the cultivations needs to be done to get them into condition for planting. In Handeni, however, famine conditions and the absence of large numbers of people from their villages render prospects for cotton more uncertain, and except in certain areas such as Kimbe where the people have long been enthusiastic growers it is not anticipated that recovery to the 1932 figure will be achieved.

52. *Rice*.—Production is mainly in the Mkomasi valley of the South Pares, and the crop is marketed in Tanga for local consumption. Railings totalled 700 tons, double the 1932 production, and it is estimated that 150 tons remain to be marketed. A further increase in area under rice is reported for the 1933 November planting.

53. By courtesy of Major Bradstock, Gonja, trial plots of Unyengwa rice (from Rufiji) and of imported rices were maintained; Carolina Edith, Mexican Edith, Lady Wright and Carolina Stormproof. Of the imported kinds Carolina Stormproof is the most promising but all of these appear to have poor keeping qualities. Unyengwa yielded well and matured in four to four and a half months compared with six months for the local Kufuli and Manikora varieties. One-acre multiplication plots of Unyengwa and Carolina Edith have been established at Gonja.

54. *Maize*.—Maize is one of the staple foodcrops of the two provinces, and is an important plantation crop in the Moshi and Arusha Districts. This year has been a bad year for maize; crops in all areas, Moshi, Arusha (an 80-per cent. failure on North Meru), Usambara and the coast were considerably reduced. Comparatively heavy imports of maize were necessary to meet the internal demand from estates and other employers of labour. Production statistics are not available, but the following are of imports into the two provinces via Tanga and Taveta, and of railings on the Tanga Line (i.e., internal movements of local maize). Maize was exported early in the year from the Northern Province, being carry-over from the 1932 crop:—

District	Import Tons	Export Tons	Railings Tons
Tanga	906	14 (includes "other grains").	—
Moshi	317	410	2,093
Arusha	—	—	140
Usambara and Tanga ...	—	—	388
TOTALS ...	1,223	424	2,621

The price has varied between Shs. 4/50 and Shs. 12/- per bag. There will be a progressive increase in production of plantation maize in the Moshi District, beyond the requirements of the local market, and some form of co-operation in marketing, possibly with Kenya producers, seems likely to be necessary. Under the terms of the Customs (Import of Maize) Regulations sixty inspections of Kenya maize imported through Taveta have been carried out, one consignment only was rejected.

55. *Citrus*.—Railings of fruit amounting to 934 tons were made from the Muheza locality, mainly to markets on the Tanga line and to Nairobi and

Mombasa, in addition to large quantities transported by road. The District Agricultural Officer, Tanga, reports:—

“The season has not been a good one and the quality of the fruit suffered through the abnormal weather conditions which prevailed during the early months of the year. Muheza is able to supply oranges through every month of the year, supplies were short during September, October and November, but at no time have oranges been unobtainable and there has been a regular weekly export to Kenya. The crops that the trees yield are surprising in view of the fact that they receive no attention or cultivation of any kind. An increasing interest in this crop is being shown by European planters.”

56. The results of trial shipments of this fruit to Bombay have already been noted.

57. *Pulse Crops*.—It has been already recorded that following encouragement from a London firm Moshi planters were encouraged to give a trial to Madagascar butter beans as a possible supplementary crop to coffee and maize, in order to take advantage of the duty on imports of foreign beans into the United Kingdom. The area under this crop was restricted by poor planting rains. The size of bean was generally rather poor, on account of the season, and careful hand picking was necessary. Prices were disappointing and fell from £17 10s. c.i.f. London in February to £9 10s. in December. Normally very good quality beans can be produced, particularly in Sanya, and at £14 this would be a profitable crop.

58. Ohtenashi beans were planted to a small extent, but at £6 per ton these are not attractive to planters.

59. Russian pea seed was received early in the season and distributed to planters for increase. Unfortunately much of this could not be planted owing to drought, but seed has been obtained for redistribution and for increase on the Native Authority Farm at Lushoto. This crop may develop as a subsidiary cash crop in the hill districts. There is at present a small production of common field peas which sell locally at high prices.

60. *Root Crops*.—There has been extension of cassava planting in the coastal areas, which has helped considerably in view of the reduced yields of grain crops. Over 700 tons of dried cassava were railed for local markets from stations on the Tanga Line. In Handeni extension of this crop has been organized in view of the rainfall being too uncertain for maize, and its planting by cultivators has been made compulsory under the provisions of the Native Authority Ordinance.

61. The production of European potatoes in the Usambaras remains about the same at 115 tons, sold locally. Heavy transport costs and lack of marketing facilities limit extension.

62. The lack of interest shown by stock farmers, and natives, in edible cannas is disappointing. Dairy farmers would have profited by such a crop in a year like this, but only one has been in the position to do so. Further distribution of planting material has been carried out.

63. *Other Subsidiary Crops*.—Brief notes are given on some crops which are at present of minor or local importance only.

64. *Fodder Crops*.—Co-operative trials with various fodder crops have been undertaken with planters interested in dairying and mixed farming and there are several crops that show promise, in addition to maize for silage. A system of mixed farming is being slowly developed and a small co-operative dairy has been started in the Northern Province, but there are few planters as yet who grow supplementary foodstuffs for their stock.

65. *Essential Oils*.—One planter in the Usambaras has recently imported a consignment of Damascus Rose, and trial plots of *Cymbopogon* spp. have been laid down, otherwise no progress can be recorded. Peppermint and geranium have been extended on the Native Authority Farm, Lushoto, but there has been insufficient material for a trial distillation of either.

66. *Tobacco*.—This crop has received attention from a number of planters and small trial plantings have been made. Two Moshi planters produce for the local market, and a parcel of Heavy Western tobacco from the Tanga District realized eightpence per pound in Europe.

67. *Chillies and Other Spices*.—There have been extensions of planting of chillies, particularly of the Japanese Birdseye variety. One planter exported 2 tons, which fetched £75 per ton at Hamburg, and 9 tons were railed from the Pares valued locally at £34 per ton. Two tons of pepper, and also nutmegs, were sold locally by one estate. Cardamons have been planted up on a small scale on two estates in the Usambaras, elsewhere trial plantings have failed.

68. *Oil Palms*.—Only one estate produces. Some new machinery has been installed.

69. *Vegetables and Fruits*.—Market gardeners have had a bad year, though railings from the Usambaras have been fairly well maintained. The production of native grown onions in Moshi has increased, railings from Moshi totalling 490 tons, mainly exports to Kenya.

70. The production of dried bananas for export has been abandoned.

71. *Cinchona*.—There has been no production this year, and no plantings have taken place.

72. *Wheat and other Grains*.—There was no planting of wheat in the Arusha District owing to drought, and the variety trials were also abandoned for the same reason. There was some planting in the Usambaras, where trials of rustproof varieties are being undertaken. Rye is also grown on a small scale for the local market.

73. *Beeswax*.—Although propaganda work and demonstrations were undertaken in 1932, production this year has been negligible.

74. *Farms and Experimental Plots*.—The citrus plot maintained by the department at Muheza has been continued with the object of supplying budwood locally, but it is not yet possible to say which of the imported varieties are best suited to the district. Two Sampson Tangelo trees have been added to the collection of varieties, and an order for further additions has been placed. A small number of budded trees have been distributed, and fresh nursery stock planted. *Calopogonium mucunoides* has proved the most satisfactory cover crop under Muheza conditions.

75. Native Authority Farms are maintained at Lushoto (14 acres), Handeni (5 acres), and also a small plot at Moshi. At Lushoto 5 acres are used as a demonstration planting of coffee on terraces, and 3 acres for miscellaneous temperate fruits. The remainder has been used for the multiplication of Potchefstroom Pearl maize, Kerrs Pink and Great Scot potatoes, and edible cannas, with small plots of peppermint, geranium and patchouli. Four tons of maize, three tons of potatoes and three tons of edible cannas were harvested. Two acres of the Handeni Farm were planted to cassava, one acre to cotton and the remainder to White Congo maize, Feterita and Bonganhilo sorghums, beans and gram. All of these failed except the cassava; one acre of cotton yielded only 23kg. seed cotton. The Lushoto Prison Farm was supervised

by the District Agricultural Officer, Lushoto. At Moshi a plot of land was terraced for citrus, but planting was discontinued owing to lack of rain. The remainder of the plot is being developed as a demonstration small holding.

76. Advice and assistance was given to the Government School, Old Moshi, for work on the school garden to which an African Instructor was seconded. A demonstration terraced plot of coffee was planted up and maintained with difficulty during the drought, and varieties of wheat and onions were also planted. Terracing and contour-hedging were demonstrated at the Msinga Chini Mission School. There was no planting on the Handeni School gardens on account of drought.

77. The number of planter and commercial visitors to the Moshi Circle and District Offices (not including the Entomologist) was 551, and to the Arusha Office, 94. Twenty planters' and Chambers of Commerce meetings were attended by members of the Circle staff, at some of which papers or talks were given.

78. The Acting Director of Agriculture (Mr. A. J. Wakefield) visited Tanga in March and April and Moshi in May. The Director of Agriculture (Mr. E. Harrison) visited Tanga in September. Mr. W. J. Moffatt, Agricultural Officer, Northern Rhodesia, toured coffee areas in Moshi and Arusha with Circle officers. The Plant Physiologist, Amani, spent some weeks in Arusha working on coffee root-systems. Other official visitors to Moshi include the Acting Director and Soil Chemist, Amani, and the Assistant Soil Chemist, Uganda.

CONCLUSION.

79. The year under review cannot be considered to have been a good agricultural year. Reduced yields of annual food and cash crops, in some cases no yields at all, brought disappointment and sometimes hardship to growers and disappointment also to officers of the departments concerned in the organization and encouragement of increased native plantings. For the producers of permanent crops such as sisal, coffee, copra and kapok, low prices particularly towards the close of the year have reduced the margin of profit to narrow proportions. Yet there has been increased production of most plantation crops (with a simultaneous endeavour to reduce costs), and continued extensions of planting. This urge to maintain a level of income by increased production is not generally present to the same degree with native peoples; increased plantings were achieved in 1933 only as the result of energetic propaganda and encouragement, which must be continued with if production is to be maintained.

C. HARVEY,
Acting Senior Agricultural Officer
i/c North-Eastern Circle.

ANNEXURE II.

NORTH-WESTERN CIRCLE — *Lake and Western Provinces.*

GENERAL.

1. The Provincial Commissioner, Western Province, has represented that the lack of staff is seriously handicapping the agricultural development in his Province. From the 20th February until the 17th May this Province was without an Officer and up to the 24th October there was only one for the five large Administrative Districts of Kigoma, Ufipa, Tabora, Nzega and Kahama.

2. The Lake Province has also suffered from under-staffing particularly in the Bukoba District where the field staff has been reduced to one District Agricultural Officer.

3. The African Staff has been augmented by the Instructor staff employed by the Native Authorities and by temporary recruitments made during the cotton marketing, seed distribution and planting periods.

4. A feature of the present year has been the close co-operation which has existed between the officers of this department and those of the Administration, and of the Veterinary and Forests Departments.

5. Shortage of staff has been in many cases compensated for by this close co-operation and a resultant even distribution of general district work.

6. The year will remain an outstanding one in the agricultural history of the Circle. A highly successful and instructive Agricultural Show and Trades Exhibition was staged in Mwanza; an Agricultural Training Centre was opened at Nyakato, Bukoba, and, last but not least, record cotton and coffee crops were obtained and the production of the other export crops was maintained at last year's level.

7. The increase in the cotton crop can be attributed to favourable weather conditions and early planting but in the case of the other crops, average yields were below normal.

8. The early rains were favourable and the combined efforts of the Provincial and Native Administrations and the Agricultural Officers ensured that natives took full advantage of them. An abnormally dry spell in March and April reduced the yields of groundnuts and food crops but was sufficient for the early planted cotton crop. It further checked the usual pests and diseases of cotton which in normal years seriously affect the crop.

9. The field work was organized and continued on the lines of the previous year. Particular attention was paid to the improvement of coffee, cotton, rice, groundnuts, sorghums and millets and to the marketing of native produce: to the use of rotations and green manures to maintain soil fertility and increase the yields per acre and to methods of cultivation and planting which would conserve the maximum amount of moisture and reduce soil erosion to a minimum.

EXPERIMENTAL STATIONS.

10. Experiments form the basis of all progress and we had reached the stage when the development of the field and demonstration work was becoming more and more difficult owing to the fact that our knowledge of the

local established crops was nearly exhausted. A class of native farmer is growing up and ideal native small-holdings are being established so that more particular information is required to provide them with the necessary knowledge to ensure success.

11. Farming under semi-arid conditions is a risk business but the risks can be minimized by the selection of varieties to suit the conditions; the judicious use of manures; timely cultural operations and the rotation of crops.

12. Since 1931 Officers have been making field selections of all crops and the excellent work carried out on these selections, along with other experiments, at the Experiment Station, Ukiriguru, by Mr. N. V. Rounce assisted by Messrs. D. Thornton and W. C. Clarke, forms the subject of a separate report.

13. The experimental work carried out at the Experiment Station, Lubaga, was very much restricted.

NATIVE AUTHORITY FARMS AND DEMONSTRATION PLOTS.

14. Native Authority farms and demonstration plots are an agricultural essential in all districts. Their purpose is manifold. They are used to demonstrate better cultural methods and serve as Ploughing Schools and Training Centres for native peasants and Instructors. They propagate approved varieties of seeds and are the recognized seed merchants of the district.

15. By the co-operation of selected cultivators the purity of the seed issued is maintained and controlled. It is repurchased by the department and the Native Authorities and reissued in exchange for mixed and inferior seed.

16. *Ukiriguru*.—This farm is now recognized as a centre of agricultural education and native pupil Instructors are sent from other districts for training. A refresher course for Instructors, which concluded with an oral examination, was held in May and by this means useless Instructors are weeded out and the general efficiency and standard of the native staff improved.

17. The following observations made at Ukiriguru are worthy of record :—

(a) *Native Hoe versus Plough* :—

Comparison of Costs.

Labour costed at 25 cents per day.

		Crop	Cost per Acre	Yield per Acre	Value	Net Profit
			Shs. Cts.		Shs. Cts.	Shs. Cts.
By Hand	...	Maize	14 -	6 bags	36 -	22 -
By Plough	...	"	15 52	8 bags	48 -	32 48
By Hand	...	Virginia Bunch				
		Groundnuts	27 38	733lb	28 98	1 60
By Plough	...	"	19 -	783lb	30 96	11 96

(b) The farm of a cultivator of Bukumbi planted with crops which he rotates from year to year. Observations made on the time taken by one of his wives to cultivate it :—

Crop		Acreage	Number of Days			Total
			To cultivate and plant	To Hoe	To harvest and winnow or sort	
Awned Millet		$\frac{1}{4}$	6	3	3	12
Maize		$\frac{1}{4}$	5	4	5	14
Groundnuts		$\frac{1}{4}$	7	10	10	27
Cotton		$\frac{1}{4}$	5	4	7	16

The complete operations occupied sixty-nine days. To cultivate and plant a one-quarter acre of millet, which yielded one bag of food (184lb.), took six days. The maize yielded 295lb. and was sold for Shs. 9/-. The groundnuts 136lb. at Shs. 8/- and the cotton 72lb. of first grade and 34lb. of second grade which realized Shs. 10/-. The number of days to cultivate a three-quarter acre of crops which gave an income of Shs. 27/- was seventeen days.

(c) *Timing of Native Cultivations* :—

Crop	No. of Days to Cultivate and Plant one acre		Cash or Food Value
	Man	Woman	
Sorghums	5½	—	1,200lb.
Groundnuts	17	28	Shs. 46/-
Cotton	—	20	„ 36/-
Maize	—	20	„ 35/-
Millet	—	24	730lb

18. *Mwasita (Maswa)*.—This farm was used to propagate the Awned Bulrush millet which was successfully introduced to this Circle in 1931 by the District Agricultural Officer, Maswa.

19. A further interesting experiment was carried out in connection with the dry sowing of Feterita sorghum. The crop was dry-sown in October and an excellent stand obtained. It will be ready for harvesting in mid-January.

20. *Shanwa (Maswa)*.—Two further generations of the groundnut strains selected in 1931 were grown and sufficient seed has been obtained to enable a comparative trial to be made next year.

21. Particular attention has been paid on this farm to the various cultural methods designed to prevent soil erosion. Where shifting cultivation is practised tie-ridges and contour ridges are advocated. Terracing can only be done where the native is permanently established on his land.

22. Suitable fodder crops such as Sudan and Teff grass were grown at Shanwa.

23. Demonstration farms were maintained in Shinyanga, Musoma, Nzega and Kahama Districts and ten acres of the Prison Farm at Tabora have been reserved for demonstration purposes and the propagation of seed.

24. Farms run in conjunction with schools follow a simple agricultural programme. Rotation of crops and green manuring are practised but the principal education is gained from the plant museum. The crops common to the area are grown in small adjacent plots. The pupils make notes of spacings, seed rates, methods of planting, dates of flowering and harvesting and the yields obtained.

25. A dairy herd is maintained at the Shanwa School where the native boys are trained to tie the cattle up and milk with two hands. Milk yields are recorded but the cows suckle their calves so that the records do not indicate the total milk yield. "The two best cows have given 1,123lb. and 1,183lb. of milk respectively, besides suckling a calf, in the lactation. Progeny from these cows and others will be bred from in 1935, in the meantime a bull from a milk-recorded cow of good performance is being used as a sire and his first progeny will be dropped this season."

26. A dairy herd has been started at Lubaga, Shinyanga.

27. Ploughing has been carried out on all farms and the oxen have been maintained in good condition by the growing of fodder crops and silage. At Ukiriguru they have been stall fed and bedded and the manure conserved in pits.

IDEAL NATIVE HOLDINGS.

28. A great deal has been written about soil erosion, over-stocking, shifting cultivation, the impoverishment of soils, the destruction of forests, etc.: a practical solution to the problems lies in the education of the native and the establishment of a class of native small farmers.

29. The fundamental reason why the introduction of ploughs has not been successful and why cattle are not an economic asset to farming is that they are not necessary to the present system. As long as the unit per family remains at two and a half to three and a half acres the plough is uneconomic and an ox cart is a luxury and not a necessity. Once the unit is raised to eight or ten acres the plough becomes an essential, cattle are necessary for working the land and transporting the surplus produce to market. In order to do this they have to be maintained in good condition so that it becomes necessary to augment the communal grazing by the production of fodder crops on the farm and the manure is returned to the land to maintain fertility and check erosion.

30. Fortunately the present system of taxation encourages native progress, in that, whatever additional income the native derives from his labour it is not subject to taxation.

31. The tendency of the more educated natives to drift to the towns has been checked by the depression and lack of employment, and a large number of natives formerly employed in Government service and by commercial firms have been forced to return to the land or remain in the towns as comparative paupers.

32. Natives, encouraged by the Government's campaign for increased production and by the improvements in the marketing of produce, have realized that their surplus production can readily be turned into cash, and there has been a definite "back-to-the-land" movement, not as a means of subsistence but as a livelihood. Agriculture has thus provided a profitable occupation for all unemployed.

33. "Necessity is the mother of invention" and it is surprising how the natives, through force of necessity, evolve agricultural practices in order to adapt themselves to changing conditions.

34. In the over-populated island of Ukara, for example, the natives have evolved a system of agriculture which embodies all modern methods. The land is kept under continual cropping, and green manuring, rotation of crops and a soiling system are practised. The cattle are stall fed and the manure is returned to the land. There is no over-stocking although cattle are a necessity to their system of farming and soil erosion, as far as it affects their cultivations, is kept in check.

35. There is an increasing scarcity of fertile land in all populated areas and rotation of land instead of crops can no longer be followed. The foregoing, coupled with the knowledge we have gained from the experiment stations and seed farms and by the demand from natives for improved seed, encourages us to believe that if a class of small farmers is set up they will be prepared to follow our teaching and adopt our methods and we feel that we have now got

sufficient positive knowledge to fix the unit of a small-holding and ensure a reasonable degree of profit to the farmer.

36. Two ideal native holdings have been established close to Ukiriguru Farm in order that, in the initial stages, the small-holders will have the benefit of the advice of the Agricultural Assistant, resident at Ukiriguru.

37. The family unit is three and the size of the holding is eight acres. They will practise mixed farming and each holding has been provided with a house, a cattle shed, a wooden plough, three ploughing oxen and two heifers. One ox cart will serve the needs of both.

38. Edible canna, elephant grass and other fodder crops have been planted round the cattle sheds and the piece of land which separates the holdings can be utilized for communal grazing.

39. Fruit trees have been planted round the homesteads which are tidy and well kept and the small-holders are at present taking a lively and intelligent interest in their holdings.

40. The success of these small-holdings depends on the individuals and is assured if they are to quote the words of Signor MUSSOLINI "True to Mother Earth. She will never refuse to feed those who are willing to work".

NYAKATO (BUKOB) AGRICULTURAL TRAINING CENTRE.

41. The Nyakato School was taken over from the Education Department in February, 1933, for utilization as an Agricultural Training Centre.

42. The object of the school is not to train natives to fill posts as Agricultural Instructors but to create a more intelligent type of native farmer. The most important crop is coffee and although a general agricultural training is given the curriculum is designed with a particular bias towards coffee. From the agricultural point of view a primary education is all that is necessary and this is given by a native teacher. Rough carpentry is taught by a native industrial instructor and particular attention is paid to the making of coffee drying-trays, wooden hullers and any article that will be useful to the native coffee grower.

43. The average age of the pupils is fourteen and during the first term thirty-four pupils attended. This number was increased to fifty-four during the second term.

44. Mr. A. E. Haarer, Agricultural Lecturer, has been in charge of the school since its inception and under his energetic and zealous guidance, loyally supported by the District Officer, the Veterinary and Forest Officers, the venture has progressed well.

MARKETING IMPROVEMENT AND EXTENSION.

45. In the past few years the quality of native produce has improved and the outturn has increased considerably. Last year improvements were made in connection with the marketing of native produce and the regulated marketing system, which previously only applied to cotton, was extended to include groundnuts and rice. In the Lake Province Native Authority markets were established in the principal trading centres, the traders renting stalls and buying the produce within the precincts of the market. A native marketmaster and native clerk controlled the market and facilities were provided for the weighing of produce and the dissemination of information regarding ruling prices.

46. This system, although by no means perfect, was generally satisfactory, but before fixing a uniform system for the Lake Province the Provincial Commissioner decided to try out three systems:—

(a) The regulated markets in trading centres, as described above, was

applied to Mwanza, Musoma and Maswa Districts.

(b) The Auction System was applied to the Bukwimba District. Auction sales were held twice weekly at the district headquarters for produce delivered at centres for a three-day period.

(c) In the Shinyanga District one central auction market was established and no other restrictions were placed on trade except that cash payments for groundnuts and gum arabic were compulsory.

47. Improvement in the weighing of produce was effected by the introduction of the Avery Platform Scale fitted with a ticket printing device. The produce is weighed and the native receives a ticket with the weight embossed on it.

48. Market returns show that the following quantities of produce were purchased:—

District			Paddy Tons		Groundnuts Tons
Mwanza	...	...	8,443	...	1,954
Kwimba	...	...	1,273	...	1,919
Maswa	...	...	—	...	1,622
Musoma	...	...	705	...	1,082

49. *Cotton*.—In consultation with the Provincial Commissioner and the ginners a scheme to reorganize the marketing of cotton was submitted to the Director of Agriculture and later approved by the Cotton Advisory Board.

50. Buying Posts were abolished and in areas of high production were replaced by Ginners' Markets. This gave the ginners equal rights to purchase the crop.

51. In areas of low production, but where marketing facilities were considered necessary, the ginners submitted tenders for the crop. The price tendered was based on American Middling four months futures and a sliding scale, to compensate for market fluctuations, was applied to that price.

52. It was agreed that no new Ginners' Markets or Tender Posts would be established within a ten-mile radius of existing ginneries or cotton markets, but the net result is that there are more buying points.

53. One of the most satisfactory features of the marketing was the application to all centres of a minimum price graph prepared by the Director of Agriculture. This has stimulated production in backward areas. The difference in the prices offered at all centres was negligible and the natives in the outlying areas received practically the same price for their crop as those who sold at the central markets.

54. Buying opened on the 14th August but was restricted to the purchase of first quality cotton until the 30th September. This improved the quality of the crop and ensured that seed from first quality picked cotton was available for distribution.

55. Approximately 8,200 tons of seed cotton were sold at an average price of 9½ cents per pound for first quality and four cents for third quality.

56. *Coffee*.—Although the marketing of Bukoba coffee has received the serious attention of the officers concerned there has been no marked improvement. The petty traders still buy good, bad and indifferent coffee and sell it in bulk to the exporters. The Produce Export (Bukoba Coffee) Rules of 1932 prevent the export of coffee not up to standard so that the exporter has to recondition the coffee before he can pass it for export. The cost of reconditioning is deducted from the price paid to the petty trader who, in turn, reduces his price to the grower. Improvements in the preparation of coffee

in the field are counteracted by this indiscriminate bulking and legislation is now being considered to put a stop to these malpractices. The Grader reports that compared to 1932 very few bags were rejected for excessive moisture. Weather conditions during the peak period were favourable and allowed the exporter to dry out his coffee quickly.

CROP PRODUCTION.

57. Again I must emphasize the importance of maintaining an efficient field staff of African Instructors in a native area. We have discovered that it is wellnigh impossible to train Instructors in general agriculture and expect a high standard of efficiency. The native staff has been reduced to a minimum, but in spite of this we have been forced to create specialists. All Instructors can read and write and they have a definite knowledge of food crops but, for efficiency, they are grouped as Instructors in the following subjects:—

- (a) Coffee.
- (b) Cotton.
- (c) Rice.
- (d) Beeswax.
- (e) Ploughing.

58. The average native family holding is three to four acres. Sixty per cent. of the cultivation is devoted to the production of food crops and forty per cent. to cash crops. In normal years if the working unit per family is taken as three, the number of days necessary to plant and cultivate the holding is twenty-seven while the average period from the commencement of the rains to the end of January is sixty-five days.

59. *Coffee*.—Mr. R. Bone, Assistant District Officer was seconded from the Administration to assist the District Agricultural Officer, Bukoba, in the difficult task of cleaning up diseased and derelict plantations and with the campaign for the regeneration of coffee trees. During the few months he was with us he rendered yeoman service which was greatly appreciated.

60. Favourable rains and the general improvement of the plantations resulted in the export of a record coffee crop of 7,922 tons. When comparing this figure with the export figures for previous years it should be remembered that the introduction of the Grading Rules was equivalent to a reduction of 12 per cent. in the weight of coffee previously exported.

61. Although the co-operation of the Native Authorities has been of great assistance in the general improvement of the coffee industry the lack of European staff to control pests and disease has been acutely felt. The Grader reports that the serious damage by *Stephanoderes* characterizes all the robusta consignments from the north and will undoubtedly be the cause of heavy rejections in 1934 unless the standing crop is protected.

62. A steady increase in coffee cultivation in the Bugufi area is taking place and over 200,000 trees have been planted. A small crop was harvested from the 1931 plantings and from now onwards a steady annual increase in production is anticipated.

63. *Cotton*.—This is the most important crop in areas where the rainfall is variable and its distribution uncertain. The yields may be low in unfavourable years but experience has proved that it will always produce something.

64. The planting of food crops is the first consideration and poor planting rains very often cause unavoidable delay in the planting of cash crops such as cotton with the result that low yields are obtained.

65. This year the early planting rains were favourable and extended into

February. Every effort was made to encourage early planting and the bulk of the crop was planted by the middle of January and the remainder by the end of January.

66. An abnormally dry spell in March checked the incidence of disease, which in normal years considerably reduces the yield and this was followed by moderate rains in April which were sufficient to maintain the crop. The combined effects of favourable weather conditions, early planting and the increased acreage that has come under cultivation resulted in a record crop of 15,000 bales as against 7,750 last year and 4,000 bales above the previous record.

67. Increased production was recorded in the Mwanza, Musoma, Maswa and Shinyanga Districts. In the Bukwimba District increased plantings of groundnuts and rice were made at the expense of cotton, the bulk of which was late-planted and yielded nothing. Production in this district fell from an average crop of 2,000 bales to 611.

68. *Groundnuts*.—This is a popular crop with natives and increased cultivations were recorded from all areas but the dry spell in March and April reduced the yields considerably. This is the principal cash crop in the Western Province and the Provincial Commissioner conducted an energetic campaign to stimulate production, which resulted in an export of over six thousand tons.

69. *Rice*.—This is an important crop in the Lake Shore belt and its production is rapidly increasing in the hinterland where a system of catchment dams is used to conserve the moisture.

70. Owing to the partial failure of the late rains the hinterland rice crop suffered severely and in many areas failed completely. Kigoma is the most important rice area in the Western Province and 23 tons of seed were distributed to stimulate production but the severe drought followed by floods did considerable damage to the crop and no marked increase in production resulted.

71. Apart from the experimental work a considerable amount of field work has been done to improve the crop and it was possible to market it by varieties. The difference in price paid for the various varieties should materially assist us in our work of eradicating the inferior types.

72. The Produce Market returns were as follows:—

			Paddy Tons.		Rice Tons.
Mwanza	...	...	8,443	...	—
Maswa	...	...	1,273	...	—
Musoma	...	...	705	...	—
Railway Exports, Western Province	...	...	1,023	...	500
TOTALS			11,444	...	500

73. *Tobacco*.—The cultivation of this crop is confined to the Biharamulo District. Poor rains resulted in low yields and an unfortunate fire occurred in the curing sheds at Ntungamo and destroyed a considerable portion of the crop. A sample of first grade leaf was sent to Messrs. R. W. Noakes, Ltd., Liverpool, who report as follows:—

"We can say that this tobacco is much superior to the two bales of previous crop which were shipped to us as representing Biharamulo tobacco. This sample shows leaf of good flavour, texture, colour and size, there is a considerable proportion of rather thin leaves which while not necessarily of poorer quality or lower value should, we think, be separated from the heavier tobacco."

74. *Sesame*.—This crop has always been of minor importance. Poor yields

and the low price paid in comparison to groundnuts do not tend to encourage production. Attempts to improve the quality by importing seed have failed and the susceptibility of the crop to disease leads one to believe that the soils and climatic conditions are generally unsuited to its cultivation.

75. *Root Crops*.—The production of root crops has been encouraged in the last few years as an anti-famine measure in the event of locusts destroying the cereal crops. The average native family cultivates from one-eighth to one-half an acre of cassava and sweet potatoes.

76. *Cereals*.—Sorghums and millets are the staple food. Maize is of minor importance and is usually eaten in the form of green mealies. The average family cultivates from one and a half to two acres which in normal years yields sufficient for their food and beer requirements. With the failure of the late rains yields were below normal and the Provincial Commissioner, Lake Province, reports that :—

“Owing to the partial failure of the long rains there were local food shortages in the Maswa, Kwimba, Shinyanga and Musoma Districts. In the Kwimba and Shinyanga Districts these shortages were slight and reserves from 1932 were sufficient for all needs, but in the Ikoma area of Musoma and in parts of the Mwagalla, Nungu, Ugarama and Kigoku Chiefdoms in the Maswa District it was necessary to issue relief. The funds for this relief were voted by the Native Treasuries concerned and adequate arrangements were made to ensure that the relief reached all those in need of it. There was, however, no question of famine in either Ikoma or Maswa. In Ikoma about 250 old or infirm people were short of food and in the Maswa District about 1,800 people had not sufficient reserves to last them until the next harvest, and are receiving assistance at a cost of £900 to the Native Treasury. In an area of this size even in a year of normal rainfall there are local shortages, but in 1933 it was only the largely increased acreage of crops which had been planted that saved us from a general scarcity of food in the Shinyanga and Maswa Districts. The Ikoma shortage was purely local, the rest of the Musoma District having had good crops.”

77. *Beeswax*.—The keen interest taken in the production of beeswax by the Assistant Entomologist (Mr. W. Victor Harris) and by his co-operation and the practical assistance he has given in the form of trained instructors have been largely responsible for the renewed interest that is being taken in all areas to produce good quality wax.

78. The Western Province exported 394 tons. Maswa exported 2,209 kilograms compared to 992 the previous year and the District Agricultural Officer, Bukoba, reports that in the Missenyi Chiefdom there are 256 working hives and that 8,664 new hives were made during November and December.

79. The total export from the Lake Province amounted to 9.27 tons but the above indicates the interest being taken in the crop.

80. *Gum Arabic*.—Out of the 1,038 tons of gum produced 951 were from the Shinyanga District.

PESTS, DISEASES AND VERMIN.

81. *Cotton*.—The leaf-curl mentioned in the last report was present but not so intense as to do much damage. This year cotton was free from disease.

82. *Cereals*.—Smuts and downy mildew were prevalent in sorghums and millets. Anti-striga measures were continued.

83. *Sesame*.—Bacterial leaf spot and aphid caused damage to the crop.

84. *Coffee*.—A heavy infestation of *Stephanoderes* was reported in the Kiziba and North Bugabo areas.

85. *Vermin*.—Birds, pigs, porcupines and baboons took their usual toll of the crops. Arsenite of soda used in baits of sweet potatoes and cassava have been effective against porcupines, but pigs and baboons have been more difficult to deal with.

86. *Game*.—Elephant caused damage in Eastern Mwangalla and in the Meatu Chiefdom. Two shamba raiders were shot by Game Scouts and one by the District Agricultural Officer.

87. Thomson's gazelles did severe damage to groundnuts, cotton and pulses grown in the open plains of Kigoma and Western Mwangalla.

88. *Locusts*.—The third campaign started in the latter part of 1932 and was continued until the middle of April. From May to September peripatetic swarms were reported from several areas but, except in the Ufipa area, no damage was done to crops during the growing and harvesting periods. Throughout the year red locusts (*Nomadacris septemfasciata*) have been present in the Ufipa area and in October the locust invasion from the south rapidly spread northwards. In addition to this, swarms of migratory locusts (*Locusta migratorioides*) from the north invaded the Biharamulo District.

89. By the end of the year swarms of mature red locusts were reported in Ufipa, Kigoma, Kasulu, Kibondo, Tabora, Nzega, Kahama and Shinyanga areas and mature swarms of migratory locusts in northern Bukoba and Biharamulo areas. Reports of egg-laying have been received from most of the above areas and an extensive anti-locust campaign is imminent.

LAKE PROVINCE AGRICULTURAL SHOW AND TRADES EXHIBITION.

90. Apart from the social and educational value of an Agricultural Show and Trades Exhibition the fact that a Province can stage a successful one is in itself a definite mark of progress. It indicates that agriculture has advanced beyond the stage of subsistence farming and that the natives have a surplus for sale and export the quality and variety of which they are prepared to exhibit. The trader realizes that this surplus produce represents money and seizes the opportunity of placing before the cultivators a variety of implements and trade goods which he hopes the natives will buy. A Provincial Show is therefore in effect a concourse of buyers and sellers the success of which is an indication of the wealth and development of the Province.

91. Mr. N. V. Rounce, Acting Senior Agricultural Officer, was in charge of the Agricultural Exhibits which were displayed in such an interesting and instructive manner that they captivated the interest of even the least imaginative native cultivator.

92. The following extracts taken from the Guide and from the subsequent report prepared by Major W. E. H. Scupham, Chairman of the Organizing Committee, are of interest as showing what was achieved:—

“During the last two or three years District Agricultural Shows have been held at the headquarters of several of the districts in the Lake Province: these shows have been fully justified by the success that has attended them, by their popularity with the native population and by their beneficial effects of increased production. The success of these District Shows gave rise to the conception of a Provincial Show, which should consist, not only of exhibits of native products from every district in the Province, but also of an exhibition of imported goods, inasmuch as the desire for imported goods is a powerful incentive to production and increased production means wealth and prosperity to all sections of the community. From these basic ideas has sprung the Lake Province Agricultural Show and Trade Exhibition.”

Agricultural Department Exhibit.

"In the investigational work of the department great importance is attached to selection within the crops of the Lake Province of higher yielding and better quality types, as well as to the introduction of varieties from other lands. Attention is being paid to the time taken in native cultivations and the cost of hand as compared with plough operations.

"The practice of shifting cultivation and ranching of cattle is not advancing the native in any way; in order to allow him a means of developing and becoming a bigger producer an attempt is being made to educate him to become an intensive mixed farmer; the principles are sound and investigations as to the best method of applying them are under way. Attention is being paid to a good type of cheap wooden plough, with which a native might find time to cultivate fodder crops for his cows, in addition to food and cash crops. In many parts of the Lake Province natives will soon have to pay attention to the rejuvenation of their soils, and this must be done by means of green-manuring and mixed farming. Numerous green manures are being dealt with.

"The Wakara, a small tribe in the Lake Province, have evolved a system of maintaining soil fertility by stall feeding their cattle and applying properly made farmyard manure to their land; in addition they use a green manure which is planted and dug in simply for the benefit of their shambas. The adoption of such methods by a native community points to the project being a practical one, and applicable to other areas.

"Emphasis is always laid on the importance of natives cultivating more systematically and planting a fair proportion of quick maturing crops to lengthen the planting period."

Agricultural Department Exhibits.

"Stands 1 and 2: *Entomological*.—Beeswax. What it is, and how to prepare it. Demonstrations of wax melting and the solarwax extractor. The uses of beeswax—candles, polish, grafting wax, etc. The Tanganyika Beehive—a queen excluder hive for native use. The European Frame Hive. A brief ciné film of the life of the bee. Exhibits of locusts, rodents, cotton pests, and insects injurious to food crops generally.

"Stand 3: *Botanical*.—Pressed specimens of weeds, culinary herbs, green-manure plants and other wild plants of economic interest such as raffia, bark cloth, gum, acacia, etc.

"Stands 4 and 5: *Mycological*.—Demonstration of dipping and treating seed against smuts of grain. Display of specimens of important and more common diseases.

"Stand 6: *Experimental Stand*.—(1) Comparative displays of actual yields of produce from plots of the following crops harvested from experimental plots: Manured and unmanured bullrush millet; native varieties of cowpeas; groundnut varieties; rice varieties.

(2) Actual yields from pure planting as compared with mixed plantings of groundnuts and maize.

(3) Incidence of rosette disease in wide spacing of groundnuts as compared with narrow spacing.

(4) Selection work demonstrating value of same by eliminating poor yielding types showing the types suitable and not suitable for selection in rice, cotton, groundnuts and sorghum. Outline of technique of selection work showing selfing methods. Results of selection showing comparative yields.

(5) Samples of introduced and local rices; of various types of seed cotton and groundnuts.

(6) Timing of native cultivations; actual produce in sacks giving time taken per man-day in producing it.

"Stand 7: *Products of the Territory*.—Products of the Territory compared with commercial samples from different parts of the world.

"Stand 8: *Information*.

"Stand 9: *Vegetative Propagation*.—Demonstration of methods of budding and grafting. Grafted and budded citrus and coffee, etc.

"Stand 10: *Native Authority Seed Farms*.—Display of produce from the seed farms of Mwasitta and Shanwa, and Ukiriguru, including yields of various crops per acre and costs by plough and by hand. Also produce of acre demonstration plot of headman of Ukiriguru farm, with value received and time taken in cultivating it.

"Stand 11: *The Agricultural Training Centre, Nyakato, Bukoba*.—Some of its activities.

Implements and Seed Storage.

"Native storage methods. Wooden plough, one-ox cart, bush-harrow, Indyebo plough, Bihar ridger, Planet Junior cultivator, pruning saws, coffee huller, coffee drying stands, maize and groundnut shellers, hand rice-huller, etc.

Demonstrations.

"Demonstrations of rein-braying, yoke, skey and strop-making, cotton sorting, harvesting rice by varieties, broom making from broom corn, seed fumigation.

Cinematograph Display.

"There will be a display of films of agricultural interest each day."

In addition to the above the following demonstrations, not entered in the Guide, were shown:—

"1. Tobacco-curing hut, showing processes from raw leaf to baling, with Biharamulo tobacco.

2. Bukoba coffee-grading stand, showing various qualities of coffee and the new pruning saw.

3. The sequence of cotton. Seed to bale to cloth.

4. The sequence of sisal. Plant to bale to rope and sisal bag.

5. Display of clean block beeswax produced in Meatu Chiefdom of Maswa District under supervision of the department.

6. Section devoted to Ukara Island and the cultural methods of the inhabitants. Numerous photographs.

7. Ukiriguru Seed Farm. Samples of hay, silage, and green manure.

8. A cotton gin in action, kindly erected by the Mwanza ginners."

"Our experience of African natives has taught us never to be surprised at their reaction to any particular phenomenon. The intense and tumultuous interest, however, displayed by native visitors in the demonstrations and exhibits which had been staged by the Agricultural Officers surpassed all our expectations and should give studious observers of the economic development of Africans considerable food for thought.

"What surprised those who had been preparing the Agricultural Section, most of all, was the extraordinary interest shown by the natives in the departmental exhibits which dealt in the main with the more technical side of agriculture and which were displayed, admittedly, in a way which it was thought would most appeal to the native.

"Parties of chiefs and headmen were conducted round the stalls by Administrative and Agricultural Officers, and Agricultural Instructors were posted to each stall."

CONCLUSION.

93. The progress recorded in this report is largely due to the Government's policy of increased production and the improvements in marketing together with the zealous manner in which officers have co-operated with the Provincial and Native Administrations to carry it into effect.

A. S. RICHARDSON,
Senior Agricultural Officer
i/c North-Western Circle.

ANNEXURE III.

SOUTH-EASTERN CIRCLE.

LINDI PROVINCE.

With the absorption of Songea into the Lindi Province the provincial boundaries are now one with the Circle. The Province is a large one and the native inhabitants, climatic conditions, agricultural possibilities and, above all, economic conditions present very different problems in the various component districts. There is undoubtedly a certain popular lack of differentiation between Lindi District, Lindi Port and Lindi Province. Thus the exports from the port of Lindi are sometimes understood to be the total exports of the Province, the ports of Kilwa and Mikindani being overlooked. The district is less than one-seventh of the total area of the Province which bears its name, but it has just under a quarter of the total population. Under present conditions the vast bulk of export produce leaving by the port of Lindi is drawn from Lindi District. Thus the association of the District with the Province tends to create an impression to the District's disadvantage, for although the District's production is actually high, when absorbed into that of the Province it naturally appears low. It would remove a great deal of misconception if the name of the Lindi Province could be altered to the Southern Province.

2. The Province has one main transport artery, the road from the port of Lindi, passing through the districts of Masasi and Tunduru to Songea, nearly four hundred miles inland. There are also two other subsidiary roads leading from the coast into the interior from the ports of Kilwa and Mikindani respectively, both linking up with the main road, the former passing through the sub-district of Liwale and joining the trunk road at Masasi and the latter from Mikindani through Newala District to Masasi. These roads are in reality merely sandy tracks, and the wear and tear on man and machine using them is high: it is along these roads that all export produce must be transported, and the cost of transport is correspondingly high. The fall in produce prices this year led to an unprecedented economic situation in the inland districts of the Province, and the transport factor became everywhere the dominant and in some cases the limiting factor in production for export. While the value of all produce has fallen the cost of mechanical transport has remained practically constant. Thus, while in former years the f.o.b. values of grain and other native produce was greater than the cost of transport over three hundred miles and more, this year the f.o.b. values have fallen to below transport costs over all but a limited area near the ports. This year the bulk of native produce has been drawn from a radius of one hundred and fifty miles of the ports. The radius for grain was less, while only the relatively high-priced commodities, beeswax and tobacco, could be evacuated by traders in the inland districts. It is necessary to recognize that the profit of the trader is the gauge to which any policy of production must under present circumstances conform: the native is so situated that he must dispose of his surplus *at any price*. Thus, provided the export value of a product does not fall below the total of transport, lighterage, wharfage, etc., the trader can continue to operate in a falling market

by the simple expedient of reducing the price he pays to the native. The trader operates on the margin between f.o.b. value and transport costs; as this margin narrows he lowers the price to the producer. When the margin vanishes he closes his doors. This year we reached the point at which certain native produce had no export value to traders outside the three coastal districts.

3. The agricultural policy has been directed in conformity with the economic situation as it existed in each district. Roughly the districts of Lindi, Mikindani and Kilwa have presented a common problem; Songea, Tunduru and parts of Liwale a second totally different problem, and the districts of Newala, Liwale and Masasi an intermediate situation.

INLAND AREA.

4. Liwale, Tunduru and Songea Districts are so situated that it is impossible for traders to export the bulk of native produce at a profit. The only produce which can stand the transport is beeswax, coffee and tobacco. So severe has been the economic plight that some natives have essayed head portage to the coast to dispose of otherwise almost unsaleable produce. From Songea to Lindi is 400 miles: a journey of 40 days there and back, a load (say sesame) 40kg., its value at the coast at 16 cents=Shs. 6/40. To carry a load of 88lb. twenty miles a day for twenty days is no mean physical feat, but to grow the load as well and then realize Shs. 6/40 at the end of the journey (working for food *en route* or fasting) would be mere folly were it not done under economic duress. A further illustration of the difficulty of evacuation of produce is given: in Lindi township Indian, Australian and Russian flour can be purchased more cheaply than flour from wheat grown in Songea.

5. The provision of cheap transport, the opening up of mineral resources, or a rise in world commodity prices would alter the case. The policy in these districts has been (a) the development of the three products which offer some chance of economic disposal, i.e. coffee, tobacco and beeswax and (b) the maintenance of adequate internal food supplies, with sufficient reserves against all contingencies, so that the areas need never require external relief and thus be an additional burden on the Central Government. With the curtailment of departmental staff only in Songea was it possible to give effect to the policy of developing coffee and tobacco. An attempt to introduce the growing and fire curing of tobacco in Tunduru District without technical European assistance proved abortive, but in Songea a promising native tobacco industry has been established under departmental guidance and a beginning has been made with native coffee growing in the Matengo hills.

6. *Coffee*.—In the Matengo hills of the Songea District native coffee growing is increasing and efforts are being made to guide it along sound lines. The Provincial Commissioner arranged for two prominent natives who had already planted out a certain amount of coffee to spend a season in Moshi to study coffee growing in an area where it was well established. These two men were placed under the guidance of the department in Moshi and displayed an admirable interest in all aspects of coffee work. During the year about 9,000 young trees were planted out by natives. These seedlings had all been raised by natives on their own initiative and much of the planting out was somewhat haphazard. A well attended meeting of actual and potential coffee growers was called in July and the many aspects and dangers of coffee growing carefully explained. The upshot was the adoption of the model and approved Native Authority rules to regulate planting and safeguard growers. Seed of

selected Kent's was obtained and planted out in tribal nurseries, and it was made an offence for anyone to plant out trees except those raised in an authorized nursery from seed approved by the department. These Matengo are amongst the most capable and intelligent cultivators in Africa and should respond well to sound instruction. No attempt to force the pace and get large scale production has yet been attempted. The aim is to get the initial growers following sound practice.

7. *Tobacco*.—In both Songea and Masasi instruction in the production of fire-cured tobacco has made good progress. Production is still small but has definitely gone beyond the experimental stage. A nucleus of trained growers has been formed. The results obtained by the more experienced growers has removed much of the scepticism with which instruction was at first received by the majority of natives. The following table shows the amount of tobacco produced by native peasant growers in kilograms:—

		1930		1931		1932		1933
Songea	...	850	...	855	...	1,897	...	6,537
Masasi,	dry season	—	...	337	...	1,170	...	1,195
„	wet season	—	...	—	...	1,230	...	1,816

It will be noticed that in Masasi a wet season and a dry season crop was grown. Tobacco growing in the dry season is the native traditional method and use was made of this fact in introducing new curing and cultural methods. Growing tobacco during the rains was revolutionary in native eyes, but two years' experience has converted all growers of the new tobacco to the view that our methods are easier of application in the wet season. The growing of Heavy Western for fire curing as a dry season crop under departmental instruction has now been discontinued. Most tobacco nursery work was under direct control, but a beginning was made with individual nurseries, giving seed to more reliable growers. Harvesting and curing was carried out under the general supervision of trained instructors (themselves ignorant of tobacco work a few years ago). Marketing was again carried out by the department. The entire crop was purchased outright from the native growers and sold by the department to manufacturers. The transaction was carried through on a business basis, with some profit to Government.

MASASI AND NEWALA.

8. These districts are situated at a distance from the coast which makes it possible for traders to evacuate certain native produce but not all. There has been a bare margin for sesame and groundnuts but none for grain. What grain has left these districts has gone as head loads. The production of fire-cured tobacco in Masasi has been given considerable attention as it offers a profitable occupation to natives, and an alleviation of the situation.

9. The southern portions of these districts bordering on the Rovuma river have been subject to recurrent food shortages. The people are in a chronic state of poverty, and a certain measure of famine relief has become almost an annual practice. With regard to "food shortages" the true position is not that there is no food but that those in need in localized areas are too poor to avail themselves of the considerable surplus of other areas. Food issues have been made in areas of shortage and relief work has taken the form of clearing and planting up new land, with a view to concentrating the population in the more productive areas. The population in the affected area is sparse and scattered and there is danger of epidemic sleeping sickness. The whole question is at

present receiving the attention of Government, and a policy of concentration has been adopted as a measure to combat sleeping sickness and for the economic betterment of the people.

COASTAL AREA.

10. *Kilwa, Lindi, Mikindani Districts.*—In the coastal districts an increase in any and every commodity was aimed at, as any increase in any commodity was a net cash gain to the people, for all surplus was saleable. During the season there was no export product in the coastal area which could not be exported at a profit to the trader, even though the prices offered to the producer were not always attractive. Particular attention was paid to cotton, sesame, groundnuts and rice, as it was considered that concentration on these crops was the best method of increasing total export value. In all four commodities an increase in exports resulted. A surplus of grain is a normal feature of this area: in the past this surplus was of considerable cash value, but we have approached perilously near the point at which it becomes impossible for traders to export grain. This season traders have exported very little and merchants hold large stocks in the hope of getting low dhow freights early in 1934. In former years these three ports evacuated the produce of the hinterland together with the district produce. This year the exports from the ports were practically entirely the product of the districts which carry their names. Thus the measure of increased production in these three coast districts was even greater than is at first apparent statistically.

11. A summary of exports for the years 1932 and 1933 from the ports is given below :—

Produce	Tons	1932		Tons	1933
		Value £			Value £
Sisal ...	6,836	68,288 (1)	...	7,817	89,060
Sesame ...	3,970	42,816 (2)	...	4,085	39,096
Beeswax ...	62	6,555 (6)	...	135	12,147
Rice ...	848	7,885 (4)	...	1,291	10,309
Cotton Lint	10	448 (11)	...	175	5,218
Sorghum ...	1,960	8,196 (3)	...	1,185	4,481
Groundnuts	296	3,178 (7)	...	425	3,727
Copra ...	887	7,676 (5)	...	467	3,649
Sesame Oil	27	1,000 (9)	...	38	1,527
Tobacco ...	44	1,168 (8)	...	45	1,458
Gum Copal	19	1,030 (10)	...	27	1,033
TOTALS	14,959	148,300	...	15,690	172,033

CROPS IN DETAIL.

12. *Sisal.*—The steady increase in production has been maintained. No estates have closed down. Sisal continues to be the chief export of the ports and constitutes one-half the total value of exports.

13. *Sesame.*—The large increase in production obtained last season has been well maintained in Lindi and Mikindani but there has been a slight drop in Kilwa. Sesame has maintained its position as the most valuable item of native produce exported. Total exports are slightly in excess of last year and the estimated carry-over is considerably greater.

14. *Beeswax.*—The tonnage of beeswax exported has been more than doubled, and beeswax was the second most valuable item of native produce

exported, being exceeded by sesame only. The increase in value, some £5,600, more than offsets the falling off in grain exports, to which it is indirectly related. The increase is attributed to propaganda amongst natives and to the fact that natives in Tunduru and Songea particularly found that much of their normal produce was unsaleable and so turned their energies to collecting beeswax, as one of the very few profitable vocations open to them.

15. *Rice*.—Rice is gaining in popularity amongst natives both as a cash and food crop. A rice hulling plant has been established in Mikindani. The season was only fair but increased planting and the low price for sorghum resulted in natives selling more rice. Exports were increased by over £2,000 in value. Rice has for two years been the third in value of native exports.

16. *Cotton*.—Owing to shortage of staff it was not possible for the department to give any attention to this crop in Kilwa District, but in the Lindi and Mikindani Districts close co-operation with the Administration, propaganda, assistance and encouragement led to a general revival of cotton as a native crop. Production did not quite equal the best years of the past, but the general satisfaction of natives—even with prices well below former levels—indicates that a further increase can be anticipated in 1934. The entire crop was purchased by Messrs. Mathuradas Kalidas at prices promulgated by the Director of Agriculture. Buying was arranged at the ginnery, Mtua, and at convenient buying-post centres in both districts.

17. Cotton seed was distributed to natives as under:—

	Seed	Growers	Percentage of Population
Lindi District ...	52 tons ...	6,631 ...	16%
Mikindani District	35 „ ...	4,715 ...	24%

18. The sales of seed cotton by natives during 1933 season are shown in the following table:—

<i>Seed Cotton (Native) in Pounds.</i>							
District	1st	2nd	3rd	Total	Value Shs.		
Mikindani	258,517 ...	20,490 ...	47,036 ...	326,043 ...	26,478		
Lindi	627,066 ...	33,132 ...	124,267 ...	784,465 ...	62,796		
TOTALS	885,583 ...	53,622 ...	171,303 ...	1,110,508 ...	89,274		

19. The decline and revival of native cotton production and its relation to price is reflected in the following table:—

	1928	1929	1930	1931	1932	1933
Tons seed cotton ...	581 ...	846 ...	277 ...	51 ...	10 ...	504
Average price cents per kilo.	39 ...	20 (end season)	16 ...	10 ...	21 ...	18

It has taken natives three years to adjust themselves to the fall in prices and to realize that a curtailment of production is no remedy but the very reverse. Although the season's prices have been below last season, there has been general satisfaction and a further increase in production is foreshadowed.

20. In addition to native grown cotton 87,465lb. of seed cotton was produced on non-native estates, mostly interplanted in young sisal.

21. The season's ginning is not quite completed at the time of writing, but from seed cotton production the output should be just on 1,000 bales of 400lb. each.

22. *Grain*.—Throughout the coastal districts crops were normal to good. In the interior local shortages occurred in Masasi. There has been a reduction of exports as prices have been unattractive. Practically no grain was exported

from inland districts as it could not stand the transport. Lindi merchants hold considerable stocks, purchased locally, against the chance of a favourable shipment, and the estimated carry-over to 1934 is above normal. The value of grain exports has fallen by £3,500. Grain can be produced in large quantities but merchants find difficulty in disposing of their stocks. At one time grain was the chief export, now it ranks sixth amongst native produce. A rise in price would immediately restore the old order.

23. *Groundnuts*.—Groundnuts have never been of major importance as a cash crop in this area. During the season effort has been directed toward increasing the proportion of land devoted to the crop. There has been a marked tendency in Lindi district, less marked in Mikindani and Kilwa, for natives to place absolute reliance on sesame for their cash requirements. The danger has been fully realized and the cultivation of cotton and groundnuts has been pushed to create a more healthy balance. Exports have been increased by about 45 per cent. but groundnuts do not yet feature as a major crop. Seed has been distributed in Mikindani and further efforts are being made to increase production.

24. *Copra*.—Low prices resulted in a reduction of output. Copra production is in the hands of Arabs and a class of native it is very difficult to influence. Copra is the mainstay of Kilwa, and less important in Mikindani, while in Lindi coconuts are only a minor crop.

25. *Oil*.—Oil extraction has become an important business in Mikindani. Exports total £1,527.

26. *Tobacco*.—The market for low grade native roll tobacco exported to Zanzibar and Somaliland has not been good and natives preferred to barter their roll tobacco locally. Exports have remained at last year's level but the value has been increased owing to the greater proportion of better quality leaf tobacco produced under departmental instruction as detailed in paragraph 7.

EXPERIMENTAL STATIONS.

27. Work at the Mpapura Experimental Station was restricted for reasons of economy, to varietal trials of native food and cash crops, demonstrations and seed multiplication. The rotation trials were continued.

CONCLUSION.

28. The outstanding feature of the year has been the whole-hearted co-operation between the department and the Administration, in the common task of raising the standard of living of the people, which can only be achieved by increasing the bulk and value of exports. How pitifully low the purchasing power of the native population actually is, is not always appreciated. The total export value is just under £1 per taxpayer per annum, or six shillings per head of the population. Over and above his food the native relies solely on the value of export produce (be it sisal from an estate or cotton or rice from his own land) to meet his liabilities to the State and to provide a margin of purchasing power. It is that margin we have aimed to increase. The work has fallen almost entirely on the shoulders of the District Officers and the measure of success achieved is a tribute to their energy. Export production comes from Mikindani, Kilwa and Lindi Districts, and these have been served by one Agricultural Assistant resident at Mpapura. The Senior Agricultural Officer was also able to act as a field officer to some small extent. In Masasi the Agricultural Assistant has been building up a tobacco industry to better the

economy of that area, and the same work has occupied the District Agricultural Officer, Songea. This is necessary spade work which is the foundation of future production. The Districts of Kilwa, Liwale, Tunduru and Newala have had no assistance beyond the services of the Senior Agricultural Officer in his advisory capacity over the whole area. It has fallen to me to review production, but the production is the work of the native with his hoe and the District Officer behind him, directing, correcting, chiding, encouraging.

C. K. LATHAM,
Senior Agricultural Officer
i/c South-Eastern Circle.

ANNEXURE IV.

REPORT OF THE ACTING ENTOMOLOGIST, 1933.

1. The Assistant Entomologist returned from vacation leave on 16th January. He has been Acting Entomologist since the departure on vacation leave of the Entomologist on 14th June.

2. While stationed throughout the year at Morogoro, a number of lengthy tours have been made and new areas visited include Mafia Island and Ufipa. At the request of the Mbosi Planters' Association a visit was paid to that area in connection with coffee pests. An exhibit was staged at the Lake Province Agricultural Show, Mwanza, in August. Demonstrations have been given at the Laboratory to scholars from the local Central School, and to African Dressers, Medical Department. Contributions to the local press on entomological topics have been made as hitherto. A list of insects injurious to crops in the Territory has been compiled for inclusion in the East African list now being prepared.

LOCUSTS.

3. Mature swarms of the Migratory or Hairy-chested locust, *Locusta migratoria migratorioides*, R. & F., were present in the west during January and February. Egg-laying took place mainly in the Lake Victoria basin, and its extension eastwards on the plateau as far as the Central Rift. In the south-west, eggs were laid on the Ufipa Plateau and in the country north of Lake Nyasa. Further east, there were eggs in Moshi District, and in the valley of the Kilombero, north of Mahenge. In Songea there was an infested area on the east side of Lake Nyasa. The resultant swarms of immature adults showed a general tendency to fly north and north-west, and at the end of June the Territory was free from migratory locusts except for a number of swarms which continued to circle around in the shallow valleys of the Ufipa Plateau. During November a number of mature swarms flew south over the Uganda-Bukoba border and egg-laying has been reported in Biharamulo.

4. Little information was received regarding mature swarms of the Red Locust, *Nomadacris septemfasciata*, Serv., until egg-laying was actually reported. There was some confusion owing to red and migratory locusts laying in adjacent areas. However, mature swarms are known to have moved north and east from Ufipa during December and January. Egg-laying took place as far north as the Central Railway some forty miles west of Tabora, and eastwards into Iringa Province. Dense laying took place in the Malangali-Nyololo River-Njombe area, between 34° and 35°W. Long. and approximately 9°S. Lat. Immature swarms circulated in the south-west, with numbers going north into Ruanda-Urundi. One swarm reached Uganda. In August there was an eastward movement into the Iringa rain forests. In November there was a further distinct eastward migration and some swarms turned south down the east side of Lake Nyasa. These latter swarms then turned east again at Songea and joined forces with the large invasion flying north during December from Portuguese territory. Northward moving swarms also entered from Nyasaland. At the end of the year mature swarms were present throughout most of the Territory south of the Central Railway from Lake Tanganyika to

the Indian Ocean with northward extensions in Singida District. Egg-laying is being reported from all parts.

5. A tour of Lake Rukwa, the Ufipa Plateau and South Tabora was made during October-November to observe red locusts during the dry season. A short paper prepared in August has been issued as Departmental Pamphlet No. 10—"The Red Locust".

COCONUT PESTS.

6. A tour of Mafia Island was made during March and April. Particular attention was paid to coconut pests, as this is one of the major copra producing areas in the Territory.

7. The major pest of coconuts in Tanganyika is the Rhinoceros Beetle, *Oryctes* spp. The large *O. cristatus*, Snell, was recorded in German times but has not appeared since. *O. boas*, F., is occasionally found attacking coconuts but is more common on wild palms and ornamentals such as *Washingtonia*. It is noticeably attracted to fresh cow dung on the Morogoro Experiment Station. *O. monoceros*, Ol., distinguished from *O. boas* in the adult stage by the shorter horn of the male and the presence of a rudimentary horn in the female, is the common species of the Territory. The condition of the plantations in Mafia was very satisfactory due to general energetic action in cleaning up fallen and diseased palms, and the relatively small area of bush containing wild palms from which reinfestation can take place. Conditions in the mainland are less satisfactory, and derelict sisal plantations add a further source of infestation as *Oryctes* develops in old sisal stumps and diseased plants.

8. The palm weevil, *Rhyncophorus phœnicus*, F., is not an important pest of coconuts and was not found on Mafia. The cylindrical black weevil *Rhina amplicollis*, Gerst., was found boring in coconut stems on Mafia. It has not been recorded previously on this host in Tanganyika, though it is recorded from a dead coconut tree in Pemba.

9. A large Cerambycid beetle *Stenodontes downesii*, Hope., was received from Mafia in 1930 and has occurred on the adjacent mainland during the year. The large legless grubs bore in the trunks of coconut palms.

10. A Tineid moth has been reared from small pink larvæ attacking male and female flowers and young nuts on Mafia. While it would appear that male and undeveloped female flowers form the main food of the caterpillars, young nuts up to one and a quarter inches in diameter were found infested. Entry was invariably at the base, and in cases where a small caterpillar had attacked a nut before the basal scales had become tightly pressed, the point of entry was obscured and the nut was apparently sound. The fully grown caterpillar is 6mm. in length, pale pink in colour, with head and first segmental shield dark brown. When pupation takes place, a small cocoon of white silk is spun in a crevice in the fruiting branch. The moths emerge under laboratory conditions in about fourteen days. They are yellow-brown in colour, dusted with paler scales; palps feathery; antennæ long; wing expanse 10mm. They are not unlike small clothes moths in general appearance. The observed effect of the young nut moth is to produce a gumming in the vicinity of the injury, followed by the complete drying up of the nut. From examination of small fallen nuts it would appear that attacked nuts adhere to the fruiting branch as a general rule. No indications were found of any connection between this insect and the disease of large nuts known as "Gummiosis" but its presence

complicates the question in the case of small nuts. Further investigation of this insect would undoubtedly be worth while.

11. Coconut Black Fly, *Cerataphis lataniae*, Licht., was found on Mafia and has since been observed in a number of localities on the mainland. Ornamental palms are also attacked. It is a small bluish-black aphid which, in the adult stage, secretes a white waxy fringe and remains stationary on the leaf. The growing point of the plant is the favourite situation but in cases of severe attack both open leaves and fruiting branches were covered. Copious honeydew is secreted and sooty moulds accompany heavy infestations. Under these circumstances, young fruiting branches were found to have withered considerably. While the presence of this insect in numbers may be taken as indicative of unfavourable growing conditions, spraying would no doubt be of value, in the case of young palms, to assist recovery.

12. *Aspidiotus lataniae*, Sign., has already been recorded from coconuts in the Territory. Four scales found on Mafia await identification.

13. The Mottle-backed Weaver Bird, *Sitagra nigriceps* occasionally causes serious defoliation of individual palms or small groups, by stripping the pinnæ for nesting material.

14. The following mammals are injurious to coconuts:—the monkey, *Cercopithecus leucampyx albogularis* Sykes., a lemur *Galagos* sp., a number of squirrels including *Heliosciurus mutabilis*, Peters., and the rat *Rattus rattus* L. On Mafia the common rat is represented by the white-bellied form, *R. r. frugivorus*, Rafin.

COFFEE PESTS.

15. In the Southern Highlands, the White Borer, *Anthores leuconotus*, Pasc., continues to be a major pest particularly in newly planted estates. Its reduction to a low level has been attained by those planters who have organized and maintained a trained gang of collectors who are now able to locate the grubs while still small, and before serious injury has been done. It is interesting to note that, despite the examination of a considerable number of trees other than coffee by departmental officers and planters in this area, no grubs of the White Borer have been received here other than from coffee, though a large number of other longicorns have been obtained. Particular attention has been paid to the Rubiaceæ, including those known to harbour *Anthores* in the Northern Province.

16. Thrips, *Physothrips xanthoceros*, Hood., has increased in the Mbosi area as the coffee has come into bearing. This was not unexpected. Early spraying has proved effective.

17. The Citrus Mealybug, *Pseudococcus citri* (Risso), Fern., appeared on coffee at Mbosi, and constitutes a new host record for the Territory. The root-infesting form has been found on coffee at Tukuyu. Banding with a grease preparation has proved an efficient control, while spraying without banding was not effective. The outbreak was small and localized. There would appear to be an impression that coffee Mealybug, *Pseudococcus lilacinus*, Ckll., has been found in the Territory other than in Bukoba. This is not so.

18. A planter reports very effective control of Dusty Ground Beetle grubs with a bait of coffee pulp and arsenite of soda.

19. During the rains there was an outbreak of snails in certain localities in the south and young coffee was killed off as a result of extensive ring barking at the collar. The snails have been identified as young form of *Achatina nyikaensis*.

COTTON PESTS.

20. Cotton in the Morogoro District has been unusually free from insect pests during the year. This is reflected in the high proportion of No. 1 grade, as shown in the figures given by the District Agricultural Officer. The results of boll examinations at Morogoro during the month of September are given below, the corresponding figures for September, 1932, are bracketed for comparison :—

Bolls No. examined	Sound %		Locules		Bollworm damage %		Stained %		Platyedra per 100 locules
400 ...	...	60.1	...	7.9	...	32.0	...	5	
		(50.0)	...	(29.1)	...	(20.9)	...	25	

Since the figures for stained locules refer to those which have not been damaged by insects as well, those locules which have been damaged and stained are shown only as damaged. A reduction in bollworm injury will therefore show an apparent increase in staining. The Kisaki area, in the south of Morogoro District, which is separated from the rest of the cotton growing areas by mountains and uninhabited bush is notorious for the high degree of *Platyedra* incidence. Figures obtained in the first week of October are given for comparison with Morogoro :—

Bolls No. examined	Sound %		Locules		Bollworm damage %		Stained %		Platyedra per 100 locules
1,050 ...	...	33.7	...	29.8	...	36.5	...	20	

While the climate of Kisaki differs to some extent from the rest of Morogoro, much of the high bollworm incidence is, it is suggested, attributable to the difficulty in enforcing the uprooting and burning regulations in that area.

21. Spiny Bollworm, *Earias* spp., was almost entirely absent. Stainers, *Dysdercus* spp., were late in appearing in numbers.

22. *Prodenia litura* was epidemic in two limited areas during April. In both cases it was associated with the common Nyctaginaceous weed, *Boerhaavia diffusa*, L. On the Morogoro Experiment Station large numbers of *Prodenia* larvæ migrated daily from *Boerhaavia* growing on the borders of the station to plots of young cotton about three inches high, returning to shade about 10 a.m. Liberal applications of calcium arsenate dust to the cotton plants proved efficient in protecting them, and with the removal of all *Boerhaavia*, serious injury was averted. In the Kilosa District, serious defoliation occurred when a cotton plantation which had been allowed to become weedy with *Boerhaavia* was subsequently cleaned. This cotton had been planted early and so was sufficiently grown to recover from the attack.

23. Reference was made in the annual report of the Senior Agricultural Officer, North-Western Circle, for 1932, to "leaf crinkle" of cotton in the Mwanza District. Examination of infected plants during the present year has not revealed any of the symptoms of "leaf crinkle" as described by Kirkpatrick in the Sudan and it is therefore recommended that this term be discontinued for the Mwanza trouble. The symptoms of the Mwanza infestation are holing of the young leaves followed by crumpling and mild chlorosis. Early reddening of older foliage takes place, and development of the plant is restricted. In severe attack little fruit is borne and lint is poor. Cage experiments carried out at Ukiriguru, by the District Agricultural Officer, showed that these symptoms are not produced by infestations of White Fly (*Bemisia ? gossypiperda*, Misra and Lamba), *Aphis gossypii*, Glov., or Jassid (*Empoasca* spp.). Control plants outside the cages showed the symptoms.

Cotton White Fly has been found to be widely distributed on the following hosts :—

Cotton, Tobacco, Cassava, *Dolichos Lablab*.

Severe infestation of Cassava in Ufipa, not accompanied by mosaic disease, appeared to have little effect on the plants. In the Mwanza experiments with cotton referred to above, artificially high infestations of White Fly appeared to accentuate the ætiolation caused by the gauze of the cages, without other definite symptoms.

24. Millipedes (Julidæ) caused some trouble in the Rufiji valley by eating newly planted seed. Mixing the seed with ashes before planting is reported to have proved a satisfactory control measure. The cricket, *Liogryllus morio*, F., was injurious to cotton seedlings at Bagamoyo. Unidentified Scarabeid grubs were reported to be cutting the stems of well grown plants at ground level in the Mwanza District.

TERMITES.

25. The use of petrol as a fumigant for termite nests having been favourably reported upon in Iringa, trials are being conducted on the Morogoro Experiment Station to determine the cheapest method of eradicating mound building termites from cultivated land. So far the most efficient method used at the Laboratory has been to pour six ounces of carbon bisulphide into the nest, making five or six holes for the purpose with a crowbar. Petrol up to one pint has proved unreliable. In each case the ground was levelled before pouring in the fumigant, and afterwards water was poured over the ground to make a mud seal. The termite experimented upon is provisionally determined as *Odontotermes badius*, Havil. A number of enquiries as to methods of destroying termites on aerodromes have been received. A collection of termites is being made for reference.

MISCELLANEOUS INSECT PESTS.

26. The Citrus Psylla, *Spanioza erythraea*, Del Guercio., is generally distributed. It is frequently the cause of much alarm when young citrus becomes infested. Permanent injury would appear to be rare among healthy plants. *Coryna apicornis*, Guer. (Coleoptera, Meloidæ), was reported as injurious to groundnut flowers. *Megalognatha suturalis*, Baly. (Coleoptera, Galerucidæ), a common visitor to the male spikes of maize appeared in unusual numbers in Mahenge. No reduction of crop was reported since the beetle does not appear to have attacked the female tassels. The Diamond-back Moth, *Plutella maculipennis*, Curt., has proved a hindrance to vegetable growing in the Uluguru Mountains.

NEMATODES.

27. To the list of host plants of the Root-knot nematode, *Heterodera marioni* given in my report for 1931 should be added *Telfairea pedata*, the Mkwemi Nut. Observation suggests that this plant is very susceptible to eelworm injury, and therefore care should be taken to choose clean ground for planting.

RODENTS.

28. There was no serious outbreak of rodents reported during the year, and the Grey Field Mouse population in Kilosa District has reverted to normal. The Rufiji valley would appear to have a high field mouse population normally during the harvest months of March and April. The Rukwa lake shores are

also liable to considerable fluctuations in the field mouse population and 1932, it has been found, was a peak period, considerable damage to crops being done. *Mastomys coucha*, the Grey Field Mouse, is widely distributed in the Territory and data is being accumulated with a view to determining the conditions under which "plagues" may be expected. Detailed life history observations have been hindered by the inability to rear this animal in captivity. The collection of specimens of other rodents of economic importance has been continued.

APICULTURE.

29. The production of beeswax in 1933 reached the new record of 1,360 cwt. This was valued at £52,751 at the coast, an average of 77·6 shillings per hundredweight. This is 4·4 shillings less than was obtained in 1932. Since the quotations for Tanganyika wax on the London market were generally higher than in the previous year, it can only be assumed that some consignments of wax not of the highest quality have been exported.

Increase in production has been fairly evenly divided between the southern part of the Territory, served by Lindi (18 per cent. of the total export) and the central and western area served by Dar es Salaam (81·5 per cent.). The increase in the south was 101 per cent.

There has been a considerable increase in the practical interest shown in Tanganyika beeswax during the last two years and it is thought reasonable to assume that at least part of the increased production is due to this. New areas have been opened up, and previously apathetic tribes have been stimulated into production. Judging from enquiries received at the Laboratory, exporters and brokers are showing a greater interest in our product.

Trained instructors have been on loan to District Agricultural Officers in the following areas during the year: Moshi, Morogoro, Maswa and Bukoba. Two natives were given a short training at the Laboratory for the Morogoro Native Authority. A number of demonstrations were given at the Laboratory during the year, and at the Mwanza Exhibition. The need for cleanliness in preparation and avoidance of adulteration has been stressed on all possible occasions. Entomological Leaflet No. 1 in Kiswahili, on this topic has been revised and issued in printed form.

A bulk specimen of wax has been forwarded to the Imperial Institute for examination. The report, when received, will be used as a basis for recommendations regarding a more uniform type of packing for export.

The keeping of bees for honey by European farmers is on the increase. Excellent honey of delicate flavour and pale colour is obtainable in the higher parts of the Territory. At least one farmer is canning this product and selling it in this and neighbouring territories. Locusts injured trees and shrubs on the Ufipa Plateau during the year and greatly diminished the honey flow.

One of the major troubles of beekeepers in the Territory is the Ratel or Honey-badger, *Mellivora* sp. This mammal, relative of the skunk and weasel, is in addition a notorious chicken stealer. It has remarkably strong limbs and claws which enable it to split open log hives or overturn all but the most securely anchored box hives. In localities where the ratel is numerous, natives suspend their log hives vertically from the boughs of high trees, or place them in rock-clefts well weighed-down with boulders.

Wax Moth, *Galleria mellonella*, can on occasion be a serious pest of stored beeswax. Though usually referred to in literature as a pest of wax combs only, stored wax can be tunnelled to a depth of half an inch with consequent loss in weight and in appearance.

ACKNOWLEDGMENTS.

30. We are indebted to the following institutions for valuable assistance in the identification of specimens:—the Imperial Institute of Entomology; Zoology Department, British Museum (Nat. Hist.); Imperial Bureau of Agricultural Parasitology; Amani Research Station, and to Mr. W. H. Potts, Entomologist, Tsetse Research Department. We are indebted to the Imperial Institute for much useful information.

W. VICTOR HARRIS,
Acting Entomologist.

ANNEXURE V.

REPORT OF THE MYCOLOGIST, 1933.

1. *Routine*.—This report is necessarily short, as the Mycologist was absent on vacation leave during the period 28th May to 29th December. During the latter period a certain amount of mycological correspondence was dealt with by the Acting Entomologist. In March and April three short safaris were undertaken to Mikesse, Mwanza and Mafia, a total of thirty-three days. The collection of indigenous plants made at the laboratory now totals 838.

2. *Extension Work*.—With the co-operation of the Holy Ghost Central Training School at Morogoro, a few lectures and demonstrations were given to the higher classes of pupils who are being trained as teachers. The subject was elementary plant pathology, and the results were sufficiently encouraging to warrant the continuation and extension of the work in the next year to other subjects and other schools. A memorandum is being prepared on the subject. Further specimens of pathological material have been sent to a number of District Agricultural Officers, who have established exhibits at their offices. Those who have taken up this scheme record its usefulness at their offices and in the field. Specimens of diseases of native crops with descriptions and control measures were sent to the Agricultural Exhibition which took place at Mwanza in September, 1933.

3. *Publications*.—Kiswahili versions of two leaflets have been published, on Root Diseases and on Coffee Bean Disease. The Kiswahili version of Mycological Circular No. 2 on Cereal Diseases has been printed as Leaflet No. 14. Three articles have been published in *Mambo Leo*. In *The Planter* published at Arusha, two articles were contributed on the root parasite *Ustilina zonata*. The second list of plant diseases in the Territory has been approved for publication in the Kew Bulletin of Miscellaneous Information.

4. *Diseases of Particular Crops*: *Acacia campylacantha*.—*Ustilina zonata* Lév. was found, for the first time in this Territory, on dead stumps and in a living tree of the above indigenous *Acacia* at Morogoro. The tree succumbed to the attack by the parasite. The point of importance is that the fungus is known elsewhere to parasitize economic species of trees, such as coffee, tea, cacao, peach, *Grevillea*, etc. The disease has been described in *The Planter*, Vol. 1, Nos. 8 and 10, 1933.

Cashew Nut (*Anacardium occidentale* L.).—A disease, characterized by angular leaf spots and stem lesions was seen in seedlings at Morogoro. While of importance in the seed-beds, it has not been observed in bearing trees. The cause has not been ascertained, but the symptoms agree closely with those of *Bacillus mangiferae*, Doidge, on mango which belongs to the same family *Anacardiaceæ*.

Cassava.—Endeavours to isolate strains resistant to leaf-curl are being continued, and the indications of ultimate success are encouraging. *Armillaria* sp., which was recorded on this crop for the first time in the previous report, has now been found in the Uluguru Mountains, in addition to the Usambaras. The fructifications of *Armillaria* have not so far been seen in the Territory.

Cereals: Sorghum.—In addition to other diseases recorded in the earlier reports, Long Smut (*Tolyposporium Ehrenbergii* (Kühn) Pat.) has been observed during the year. The only previous record of this smut in the Territory was made by Busse in 1904. In May, 1933, it was sent to the Laboratory for identification by the District Agricultural Officer, Shinyanga, in whose district it was stated to be widely distributed, although not common. It was later observed in the Morogoro District at Mkuyuni. The smut is already described in Mycological Leaflet No. 11, which deals particularly with the better known smuts of this crop.

A useful report from Shinyanga brings out the following points of interest. Grain Smut is by far the most common smut in that district, particularly among native mixed varieties of sorghum. Among the latter, in five localities, the percentage of affected heads varied from 8 to 43 per cent. with an average of 25 per cent. Among pure stands of ten distinct varieties the average percentage of infection was only 2.6 per cent. If the latter pure seed were grown in place of the susceptible mixed seed, an insignificant amount of loss would be experienced, and no seed treatment would require to be advocated. Figures indicate also that loss from downy mildew would likewise be decreased. An unnamed variety in a native plantation was found to have 100 per cent. of heads infected with grain smut—a degree of infection which had not previously been seen, and which has only been equalled by head smut in maize in the Uluguru Mountains, recorded in the previous report.

A very common parasite of young sorghum is *Ascochyta sorghina* Sacc., which causes long grey dead areas on the leaves (on which the numerous tiny perithecia are clearly seen). Older plants do not appear to be infected, nor to suffer from the earlier infection.

No smuts were observed in a single plot of broom-corn. Downy mildew was present, though not so general as on sorghum. On an old stalk of sorghum perithecia of *Ophiobolus* sp., were observed.

Two hundredweights of sulphur were distributed for seed treatment of sorghum against grain and loose smuts. Seed treatment with copper sulphate effected reduction of infection in plots at Mwanza.

On the Ukiriguru farm, among forty-eight varieties of sorghum, each of which was represented by fifty or more distinct plants, the infection by downy mildew varied greatly—from 0 to 26 per cent. Although infection had been noticed a few weeks before observations were made, the plants were not fully mature, being only ten and eleven weeks old; it is unlikely that any variety is really immune. As diseased plants of this crop bear no heads, there is considerable loss; this could largely be prevented by using the less susceptible varieties.

Maize.—*Diplodia macrospora*, which has been recorded previously as one cause of maize ear-rot, has been seen causing a leaf-spot on this crop.

Citrus.—An experimental consignment of oranges and lemons sent by the Department of Agriculture to London were found to have the following fungi present, as identified at the Imperial Mycological Institute, Kew:—*Penicillium digitatum*, and stem-end rot in orange caused by *Diplodia gossypina*, Cooke (syn. *D. natalense*, Pole-Evans). From an orange fruit which had a large dry leathery dark-brown area with a minute puncture at the centre, the following fungi were isolated: *Phytophthora palmivora*, *Colletotrichum glaucosporioides*, and a species of *Polyopeus*, a genus which had not previously been recorded on citrus.

Coffee.—*Armillaria* sp., was observed at Mbosi, which indicates a wider range of this parasite in coffee than was known.

Cotton.—Crinkle disease has been suspected in the Mwanza District, but has not yet been proved satisfactorily.

Cowpea.—It is recorded by officers at Mwanza that "all early plantings of cowpeas, and in fact other leguminous crops, such as tepary beans, were badly infected with virus disease during April and May, but the February plantings escaped." This observation indicates that the method of controlling Rosette of groundnuts by early sowing may apply also to other leguminous crops, but confirmation is required.

Groundnuts.—The reputation for relative immunity to Rosette disease possessed by the varieties Basse and Philippine White, which had been imported from Nigeria, has not been maintained in plantings at Mwanza. Early and close planting remain our best control measures.

Hibiscus csculentus.—Perithecia of *Glomerella* sp. were observed on old stems. On old fruit *Myrothecium roridum*, Tode, was common.

Peach.—Crown-gall has been identified on peach trees at Iringa.

Sesame.—Leaf-curl was less severe at Morogoro than in 1932; it was seen also on Mafia Island. Enations on the leaves similar to those which occur in tobacco leaf-curl were noticed, and may indicate some relationship between the two diseases. The bacterial leaf-spot mentioned in the previous report was seen at Mwanza and Morogoro. In addition to the *Helminthosporium* recorded already, *Cercospora Sesami*, Zimm., has also been defined as a cause of leaf-spotting. The common mildew has not been seen in its perfect stage, but is a species of *Erysiphe*.

An experiment which was laid out to test the effect of seed treatment with certain bactericides on the common bacterial disease of this crop was rendered ineffectual through lack of rains and consequent poor germination and growth.

Sisal.—Diseases observed during the year are the common ones described in previous years. In the case of "banding disease", it is recorded from a Tanga plantation that considerable improvement was effected by the use of dressings of potassic and phosphatic manures, the application of which was regarded as being economically sound. The stem-rot disease previously only known in one district on the central line, appears from descriptions to occur also on the south-east coast. There have been a number of cases of sisal suffering from drought.

G. B. WALLACE,
Mycologist.

ANNEXURE VI.

REPORT OF THE SENIOR AGRICULTURAL ASSISTANT.

The duties of the Senior Agricultural Assistant have been mainly divided between Head Office and the Morogoro Experiment Station throughout the year. Assistance was given in the field to the increased planting campaign in the south-western area of the Morogoro District.

2. My duties on the Morogoro Experiment Station were concerned with the regeneration of the fruit blocks, the propagation of nursery stock of fruit and ornamental plants for disposal to planters and others at nominal gazetted prices. How far this feature of departmental activity is necessary may be judged from the fact that importation permits under the Plant Pest and Disease (Import) Regulations were issued during the year for the importation by private individuals from other countries of over 24,000 plants, mainly fruit plants, and exclusive of any other kind of planting material. Most of the kinds and species of plants so imported are already being grown in the Territory, and with the provision of planting material from within the Territory, a service is given which benefits the planter by providing plants at nominal rates, does away with the risks attendant on getting plants from long distances from overseas; and further, will do something to eliminate the possibility of the introduction of pests and diseases from other countries. There are as yet no commercial nurseries in the Territory capable of dealing with the situation, and the Experiment Station nurseries, owing to their elevation, are limited to the growing of strictly tropical plants. Some thousands of fruit and ornamental plants are now available for disposal.

3. New plantings, in limited numbers, have been made on the Experiment Station of McCarthy, Triumph and Duncan grapefruits, Ruby Blood, Pineapple and Binti Juma oranges, citron, sweet lime, Rangpur lime, Villa Franca lemon, sapodilla and litchie.

4. Reference was made in the last annual report to the budding and grafting of *Coffea arabica* scions on to stocks of *Coffea excelsa*. The scions particularly referred to have made excellent growth and are now in full fruit. From observations, it appears that grafts make much better unions to the stock than buds. There are some peculiar features to be noted in the growth of coffee buds and grafts. Buds inserted into lateral shoots will develop only lateral growth, and throw out multiple shoots from the original bud. Buds inserted into main stems or leaders will produce upright, normal single stems. Grafts, other than those of terminal shoots, do not develop a main stem, irrespective of where the scion is inserted. Seedlings of a number of varieties of coffee have been grown and grafting done under ordinary nursery conditions with extremely good results. A wardian case of grafted coffee plants (*C. arabica* on to *C. bukobensis*) was sent to the Coffee Experiment Station, Moshi.

5. A collection was made of scions of the better types of mango in the Territory, and these scions were successfully grafted on to nursery seedlings. These grafted plants will form the basis of a collection of named superior mango varieties for the Experiment Station.

6. The cherimoya, *Annona Cherimola*, probably the best of all the *Annona* fruits, does not thrive on its own roots at Morogoro, but by budding on to stocks

of *A. reticulata* and *A. muricata*, fine healthy growth is produced. It is indicated that *A. muricata* is the better stock.

7. It is as yet too early to express a definite opinion as to the ultimate success or otherwise of the trial plantings of Criollo cocoa in the foothills of the Nguru and the Uluguru mountains. In spite of a most unfavourable season a fair number of the seedlings survive. It is indicated that with a normal season to enable the plants to become established, the extension of the growing of this high grade cocoa is possible in selected localities. Further and more extensive planting trials are being undertaken this coming season.

8. A consignment of citrus fruit sent from the Tanga Province to the Empire Marketing Board, London, received a very encouraging technical report, and the report states that there would appear to be good prospects of developing a trade if substantial quantities of well-graded, evenly coloured fruit are available. Further consignments, graded and packed to standard requirements were sent to the Empire Marketing Board, London, and to Bombay. The report on the former consignment is awaited. Good prices were obtained for the consignment sent to Bombay.

9. A survey was made of the reports of trials with the tung tree in various parts of the Territory, recording details of seed distributions and of the different conditions under which the tung tree is being tried. It is clearly indicated that it is yet too early to arrive at definite conclusions as to the suitability of the tree in certain areas. The most promising reports are from parts of the Iringa, Rungwe, Ufipa (Kasanga), Ujiji (Uvinza) and Bukoba Districts. A further survey of reports will be made in 1934. On the Morogoro Experimental Station, the tung tree has a definite wintering period which ends with the coming of the small rains in November-December.

10. Planting material of Attar of Roses, *Rosa damascena* was successfully introduced to the Experiment Station from Cyprus and India, and plants and cuttings have been sent to the Southern Highlands and the Northern Province to planters interested in the production of essential oils. Peppermint, *Mentha piperita* was also propagated and similarly distributed.

11. At the request of the Rockefeller Institute for Medical Research, New York, a further consignment of seed of the indigenous *Strophanthus Eminii* was collected for the continuation by the Rockefeller Institute of the investigations into the glucosides of this species. Previous results of investigations were published in the *Journal of Biological Chemistry*, xcix, No. 2, January, 1933. A consignment of seeds of this species was also sent to the Imperial Institute for comparative examination by the Pharmacopœia Commission. The question of a market for this seed will be settled if and when the seed is included in the British Pharmacopœia.

12. Samples such as ramie fibre, wild cardamoms, peas, lemon-grass oil, equellor oil and other plant products were submitted to the Imperial Institute for technical reports and commercial valuations. Acknowledgment and thanks are due to the Imperial Institute for their ready co-operation.

13. A range of standard commercial market samples have been obtained, and are available together with information regarding them, to anyone interested.

14. Plant and Seed Introduction will be found in Appendix II of the Report.

T. H. MARSHALL,
Senior Agricultural Assistant.

ANNEXURE VII.

MOROGORO AGRICULTURAL STATION.

REPORT FOR THE YEAR 1933.

1. *Meteorological*.—Conditions throughout the year were extremely dry, the main rains being late and particularly light. Good planting conditions were obtained during and after the short rains in December, 1932, and January, 1933, and as many as possible of the crops were planted in January. The following table gives the distribution of rainfall (in mm.) throughout the year together with figures for 1932 and for the period 1925-31 :—

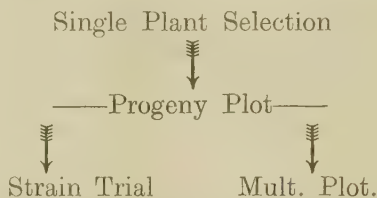
Month	1933	1932	Average 1925-31
January	203·4	47·9	99·4
February	72·9	192·6	75·7
March... ..	59·4	116·5	136·8
April	112·8	175·6	164·4
May	26·2	94·4	79·7
June	0·0	6·7	20·8
July	1·1	9·7	7·2
August	6·4	3·9	11·2
September	2·9	16·9	23·8
October	8·5	3·5	27·0
November	41·8	10·4	43·1
December	29·1	229·3	93·9
TOTAL	564·5	907·4	803·0

2. *Cotton*.—The Morogoro Agricultural Station is designed primarily to serve the coastal belt in the improvement of cotton. For several years improvement had been sought by the introduction of strains from other countries but this measure proved unsatisfactory. The introductions which gave the best results were the U4 strains from Barberton, South Africa, and Gatooma, Southern Rhodesia, unselected U4 bulk giving better results than any of the later strains. In the first year of introduction most of these U4 strains give yields far in excess of the local cotton, but this superiority in yield quickly lessens in succeeding years until the yield at Morogoro is little if anything higher than that of the unselected strain at present grown. Again, the lint of the U4 strains is not so good as that from the local cotton with the result that a lower price is obtained and the increased yield does not necessarily compensate for the lower price per pound of lint with the result that a lower net return per acre is possible. Selections have been made from the U4 group with a view to improving the qualities of the lint and although some measure of success has been attained it has been found that selection for lint quality has resulted in a decreased yield per plant. The strains will be continued, however, on account of their jassid resistant properties.

3. The cotton at present grown in Tanganyika is derived mainly from the stock introduced from Uganda in 1921-22, and selection is now being carried out on this so-called "local" strain with a view to improvement of both yield and quality of the lint. The average yield obtained by native cultivators is

estimated at 500lb. of seed cotton per acre although individual yields in excess of 1,000lb. per acre have been recorded. At present the lint of Native No. I cotton commands a premium of 1.20 points over American Middling.

4. With regard to cotton improvement, work on a definite plan was started in 1932 when several hundred single plant selections were made from the U4 group and from the local strain. Those from the U4 group were made chiefly with a view to improvement in the lint and as already stated this improvement has resulted in lower yields per plant. On the other hand the selections made from the local strain have shown considerable promise in progeny plots this year and are being tested against the local unselected parent material in 1934, the sequence being :—



At the present time improvement will be confined to single plant selection.

5. *Cotton Variety Trials*.—A continuation of Variety Trial No. I (1932) was made in order to test further various U4 strains between themselves and against the local unselected strain. The varieties were :—

Local.	H67.
U4 bulk.	H77.
U4/4/2.	C15.
U4/4/10.	Z14.

The trial was laid out on the Randomized Block system, there being six replications of the eight treatments. Plots were of four rows each, 22 yards long, records being taken from the two centre rows only. No significant difference was obtained between local, U4 bulk, U4/4/2 and U4/4/10; local and U4 bulk gave significantly higher yields than H67, H77, C15 and Z14. As a result of the variety trials conducted in 1932 and 1933 these last four varieties are being discarded.

6. *Variety Trial No. II (1933)*.—A continuation was made of Variety Trial No. II (1932) started in that year. The trial which was laid out in the form of a Latin Square included the Uganda variety S.G.29, a strain which was produced in Uganda and which has attained a considerable amount of success there. The varieties were :—

Local.	U4/4/10.
U4 bulk.	S.G.29.

Individual plots were 7 yards by 7 yards with discard rows round each plot and a clear space of six feet between each plot. Significant differences in yield were obtained only in the case of S.G.29 which gave a lower yield than any of the other three varieties.

7. Reverting to an analysis of the introduced cottons it can be said that quite apart from lint quality, of the U4 group the varieties C15 and Z14 are unsuited to conditions in the coastal belt. They are too early maturing to carry a heavy crop and should unfavourable conditions (such as drought or insect attack) supervene there is considerable danger of losing almost the entire crop as the strains produce their crop early and within a definite period. On the other hand the local commercial strain produces its crop over a long period and should the plants receive a set-back early in the season they are

usually able to produce a crop later on. Also, boll shedding is very high in C15 and Z14. H67 and H77 are of a better type but have not given yields sufficiently high to warrant their retention.

8. *Moco Cotton*.—A small quantity of seed of Moco cotton (*G. purpurascens*, Poir) a perennial tree cotton from South America was received from Dr. Harland, Trinidad, via the Empire Cotton Growing Corporation, London. A few flowers were produced but no seed was obtained during the first year of growth. The plants are being kept on for further trial in 1934.

9. *Sakel Cotton*.—The Sakel cotton planted at the Agricultural Station this year has not given good results, only a few ounces of seed cotton being obtained from a one-fortieth-acre plot. The plot was irrigated regularly throughout the dry season.

10. *Sorghum Varieties*.—A collection of sorghum varieties from different parts of the Territory was made during the year. Seed of the varieties was sown in three-row observation plots. Detailed botanical records have been made and herbarium specimens of each variety forwarded to the Royal Botanic Gardens, Kew. Many of the varieties from the hinterland have a close head and are therefore unsuitable for production in the coastal belt as the humid conditions prevailing in the heads are favourable to the growth of insect and fungoid pests. Selections have been made from open panicle types and these will be planted in progeny plots in 1934.

11. *Sisal vs. Furcræa Yield Trial*.—A yield trial between Sisal and *Furcræa gigantea* was laid down in 1931 using the Half-Drill Strip method. The *Furcræa* undoubtedly produces much more rapid growth than the sisal and being spineless is easier to handle. A first cutting has been made from the *Furcræa* and that from the sisal will be made in 1934.

12. *Sisal Cultivation Experiment*.—A sisal cultivation experiment on the Randomized Block system was laid down in the beginning of this year in order to test the relative merits of different forms of cultivation in sisal. The treatments are :—

- (i) Weeds cut at 6 inches height.
- (ii) *Dolichos Hosei*.
- (iii) *Crotalaria invariantulensis*.
- (iv) Scuffling.
- (v) Deep cultivation (6 inches).
- (vi) Treatment similar to No. 4 with the addition of 2-3 ounces of sulphate of ammonia per plant.

There are six replications of each treatment. Of the cover crops employed, *Dolichos Hosei* appears to be suited to more humid conditions as very poor cover was made. *Crotalaria invariantulensis* also produced a rather poor covering effect and the plants were unable to persist throughout the dry season. These cover crops will be replaced by two local species of *Crotalaria* in the coming year.

13. *Cassava*.—Work on cassava has been confined to observations on disease resistance and as vegetative propagation has given disappointing results new varieties will be raised from seed.

14. *Fodder Crops*.—A number of crops for use in stall-feeding the cattle have been planted up during the year. Of these the most important are Edible Canna, Lucerne, and Kudzu vine. It has been found that the Edible Canna gives a very high yield of green material if heavily manured and irrigated

throughout the dry season but on the other hand plots receiving either manuring or watering and plots receiving neither have given very low yields by comparison. The leaves of the Edible Canna are readily eaten by cattle but it was found that the rhizomes were not consumed unless feed was very scarce. Lucerne gave a poor yield and as the crop appears to be unsuited for this area no further trials will be made. All available roots of Kudzu vine (*Pueraria thunbergiana*) have been planted up for future supplies of fodder.

15. Although not primarily used as fodder crops, mention must be made of the Lima and Madagascar Butter Beans (*Phaseolus lunatus*) which proved so successful this year. In previous years all orchards and permanent plantations were sown with Cowpeas in order to suppress weed growth but this year Lima Bean has been used exclusively. The plants persist throughout the dry season and during the short rains the plots become self-sown with any seed that may have fallen to the ground. The crop grown in the orchards was used exclusively for feeding to the cattle. The Madagascar Butter Bean gave results better than Lima Bean if anything, and as this crop was planted in the open land of the Agricultural Station the cattle were allowed to graze the plants after the beans had been harvested.

16. *Multiplication Plots.*—Multiplication plots of Potchefstroom Pearl Maize, White Congo Maize, Madagascar Butter Beans and Lima Beans provided material for sale or distribution.

17. *Livestock.*—In addition to the herd of grade cattle, a small herd of work oxen was maintained at the Agricultural Station during the year. As in 1932, trypanosomiasis (chiefly *T. congolense*) proved the only serious factor in the keeping of grade stock but with the adoption of Antimosan as the standard treatment in place of the cheaper Tartar Emetic, losses have been considerably reduced. Three bull calves were sold to planters during the year and a further lot will be available soon; the calves are Friesian and Ayrshire grades. The adoption of work oxen at the Agricultural Station has reduced the costs of cultivation considerably and has enabled a greater area to be taken into cultivation. The number of livestock at 31st December, 1933, is: 2 bulls, 16 cows, 4 heifers, 11 calves, 6 work oxen.

J. ROBERTSON,
District Agricultural Officer
i/c Agricultural Station, Morogoro.

ANNEXURE VIII.

REPORT ON EXPERIMENTAL WORK, 1932-33.
UKIRIGURU STATION.

CONTENTS.

1. Selection Work.
2. Observation Work.
3. Experimental Plots.

ANNEXURES.

1. Lake Province Rice.
2. Details of Rice Selections (*not published*).
3. Details of Sorghum Varieties (*not published*).

STAFF.

N. V. Rounce, District Agricultural Officer.

D. Thornton, District Agricultural Officer.

W. C. Clarke, Agricultural Assistant.

An agricultural station was started at Ukiriguru in November, 1932, on a piece of land handed over to the department by the Native Authorities from the existing acreage of the Native Authority Seed Farm. The proximity of the Experimental area to the Seed Farm has many advantages and owing to the system of costing, nothing disadvantageous. As accurate information is gained from the experiments so is it put into practice on the Seed Farm.

The work on this station was divided up into three sections:—

1. Selection work.
2. Observation work.
3. Experimental plots.

I.—SELECTION WORK.

(a) *Sorghums*.—Large panicles of most of the varieties of sorghum in Mwanza and Kwimba Districts were planted in panicle rows in three series. Heads of each parent were selfed and it is intended to select within the progeny of the selfed parents, plants of unusually good character. Difficulty was found in getting spikes of *Pennisetum* to set in selfing bags. No such difficulty was found with sorghums. In *Pennisetum* there appears to be much less overlap between the ripening of the stigmas, which appear first, and the opening of the anthers, compared with Sorghum. The inflorescence of *Pennisetum* is definitely suited to cross-fertilization. This work has also served to give us details of vegetative and grain characteristics of most of the varieties. The yields as between one variety and another cannot be taken as significant but some tentative information may be gained by dividing the yields up into three sections, i.e. high-yielding, medium and low-yielding. It is of interest that the highest yielder of all "Kishitanginho", not a very common variety in the district was commented upon by numerous parties of natives, particularly the

old men, as a promising variety. Yields were taken on the random sampling system whereby yard lengths are harvested at random. The saccharine character is determined by the colour of the midrib. Identification can also be done by cutting the stem. Saccharinity varied within the panicle row itself and as between the progeny of one panicle and another of the same variety, owing to past hybridization. Some varieties however were typically saccharine, and as such would tend to decrease the productivity of the soil when dug-in. The following details of eighty-two varieties of sorghum, some varieties being duplicated from Kwimba District will be found in Annexure :—

Height. Saccharinity. Colour of sheath. Number of tillers. Leaf colour when young. Percentage of attack by Downy Mildew. Storage qualities. Period to maturity. Type and size of panicle. Colour and size of seed. Yield per yard.

The Sorghum varieties have been classified as follows :—

Saccharine Sorghums.

1. Mwanakwimba of Mwanza.
 2. Mwessa.
 3. Boya.
 4. Ngalya.
 5. Boyagagi.
 6. Kandi.
 7. Kabili.
- Panicle rows giving a variety of both saccharine and non-saccharine.*
8. Nghollongo Igigo Iya Ngombe.
 9. Nghollongo.
 10. Bukura wa Bakara.
 11. Bambale.
 12. Machimu.
 13. Nghome ya Ihishi.
 14. Bugussa.

Medium Maturity Sorghums.

1. Kandi.
2. Mbiti.
3. Nandele.
4. Musoso.
5. Chelwa.
6. Nzanza.

Short Sorghums. Under 4ft. 6ins.

1. Baragwa.
2. Kipamabajinga.
3. Bukura wa Bakara.
4. Kishunulila Ngungu.
5. Shimbewanera.
6. Matumbati.
7. Machimu.
8. Kuja.
9. Kabunde.

Good storage Sorghums.

1. Kanyanya.
2. Nghollongo tembe.
3. Wiru Bumabele.
4. „ Boya.
5. „ Yemba.
6. „ Nyawawa.
7. Musoso.
8. Chelwa.

Early maturing Sorghums.

1. Kanyonga.
2. Wiru Nyawawa.
3. Bukura wa Bakara.
4. Nyakasala.
5. Nyawirika.
6. Kabunde.
7. Kuja.
8. Buchiyeki.
9. Nzanza.
10. All Ukerewe Sorghums early or medium maturing except Wiru.

Twin-seeded Sorghums.

1. Nghollongo Igigo Iya Ngombe.
2. Nyakasale of Kwimba.
3. Kabili.

Possibly particularly susceptible to Downy Mildew.

1. Mwanakwimba.
2. Kanyonya.
3. Mwessa.
4. Nghollongo Igigo Iya Ngombe.
5. Wiru Nyawawa.
6. Nghollongo (undoubtedly).

Order of Yield, 1932-33.

Undertaken by the sampling method, i.e. harvesting yard lengths at random, where possible four one-yard lengths being taken per panicle row :—

High yielders.

- | | | |
|-------------------|--------------------|-------------------|
| 1. Kishitanginho. | 4. Nandele. | 8. Magohe (Wiru). |
| 2. Boya. | 5. Bukara Mahemba. | 9. Ndulunganhya. |
| 3. Nzanza. | 6. Kuja. | 10. Ngalya. |
| | 7. Kabili. | 11. Kabunde. |

Medium yielders.

- | | | |
|----------------------|-----------------------|--------------------------|
| 12. Solyu. | 22. Nyawiruka. | 31. Nyakasala. |
| 13. Nzazani. | 23. Kanyonya. | 32. Mutunguru Wabaragwa. |
| 14. Nyawawa (Wiru). | 24. Nghollongo Igigo. | 33. Idutubija. |
| 15. Nyallamiwanoni. | 25. Nghollongo tembe. | 34. Chelwa. |
| 16. Bukura Masara. | 26. Shimbewanera. | 35. Bulimbu. |
| 17. Boya (Wiru). | <i>Low yielders.</i> | 36. Boyagagi. |
| 18. Ngoa. | 27. Nghollongo. | 37. Baragwa. |
| 19. Yemba (Wiru). | 28. Bwiru of Ukerewe. | 38. Kipamabajinga, |
| 20. Mwessa. | 29. Bukura wa Bakara. | Mwanza. |
| 21. Bumabele (Wiru). | 30. Mwanakwimba. | |

Unclassified.

The rest.

The "Wiru" class is a prominent one and has valuable characteristics :—

1. White-grained with white flour.
2. Medium to high-yielding.
3. Good storage qualities.
4. All non-saccharine.
5. All tall.
6. Excepting "Nyawawa" not very susceptible to Downy Mildew.

There are two unfavourable qualities however :—

1. Loose panicle allowing damage by birds and locusts.
2. Difficult to thresh and remove all glumes.

It has not yet been ascertained, however, as to what extent these two characteristics would affect the popularity of this class of sorghum. Neither of them appears to be of great significance.

It is interesting to note the comparatively high position in the yield series that the following early-maturing sorghums have taken this year :—

1. Kuja.
2. Kabunde.
3. Nandele.
4. Nzanza.

Owing to the fact that each panicle was dipped in copper sulphate, almost no smut appeared and hence no observations have been made on resistance to the various smuts. Downy mildew, however, was a controlling factor in yield and accounts for many of the varieties being unclassified as to yield, together with the fact that germination in many cases was poor, in particular with the Kwimba sorghums, for reasons unknown.

Variety trials are to be undertaken in the coming season within the short varieties, the "Wiru" class, and the best of the remainder.

(b) *Groundnuts*.—A total of 84 single plant selections were taken from both Virginia Bunch and the semi-upright native type, the former on the basis of number and size of nuts and colour of shell, the latter on a weight basis. All the latter were above 3oz. whilst the average per plant for the field taken from four randomized one-fortieth acre quadrats was 1½oz. per plant. These will be planted in plant plots next year.

(c) *Cotton*.—253 unselfed single plant selections were planted in plant rows. These were selected from the field in 1932, for the characters of resistance to disease, yield and shape. Ten plants of each were selfed by tying up the corollas with gunny twine or sisal fibre. When they were far enough advanced all but 51 were discarded by eye and some more single plant selections taken. After further examination by laboratory tests 15 selections remain and the

selfed seed of these will be planted in strain trials in 1933-34 and mother plants selfed for carrying on the strain type. Details of the final selections are as under :—

	*Lint lengths	Ginning %	Strength	Weight 100 seeds	Lint Index	Disease Resistance
Mz. 32437	1 $\frac{1}{8}$	31.98	S	6.30	2.96	good.
32509	1 $\frac{1}{16}$ (full)	32.22	S	7.57	3.59	good.
32527	1 $\frac{1}{8}$	32.75	F.S.	7.82	3.81	
32580	1 $\frac{1}{8}$	33.58	S	7.36	3.72	very fair.
32553	1 $\frac{1}{8}$	32.00	W	8.10	3.81	fair.
32559	1 $\frac{1}{8}$	31.95	S	7.32	3.44	
32561	1 $\frac{1}{8}$	31.35	S	7.65	3.46	very good.
32570	1 $\frac{1}{8}$	34.60	W	6.63	3.50	good.
32572	1 $\frac{1}{8}$	32.68	W	8.45	2.17	good.
32576	1 $\frac{1}{16}$	33.55	S	7.58	3.90	fair.
32579	1 $\frac{1}{8}$	35.00	S	7.42	3.99	fair.
32602	1 $\frac{3}{16}$	32.35	S	8.32	3.97	good.
32604	1 $\frac{1}{8}$	33.17	V.S.	7.87	3.88	fair.
32613	1 $\frac{1}{8}$	31.54	W	8.50	3.91	fair.
32655	1 $\frac{1}{8}$	31.25	S	8.05	3.66	fair.

*Tested by combs and halo measurer in inches.

†Strength was tested by hand and the results cannot be relied on too much.

No. 32561 was strikingly resistant to disease. The selections as a whole compared very favourably indeed by eye with cotton from mixed local seed planted in the same block at the same time on similar soil. The aim of selection is to get a slightly better lint length than obtains at present, but with a higher yield and disease resistance. The mean lint length of the 51 remaining selections was one inch. Sixty new selections from the field were made of which ten were supplied by the District Agricultural Officer, Maswa.

(d) *Rice*.—This work was undertaken on a plot of ground in Mwanza Township and comprised 202 selections of nine varieties, of which half emanated from the District Agricultural Officer, Musoma. Each selection comprised one panicle, 25 of whose progeny were planted in a panicle row. One panicle of each selection was selfed owing to the risk of cross-fertilization with so many strains planted so close together. Tiller counts, vegetative habit and other necessary details were taken for each row so that selections could be discarded on this data. The selfed panicles of these selections have been planted under irrigation this dry season, in order that sufficient selfed seed of each strain may be available for strain trials in 1933-34. Hybrids appeared in both Bungala and Majimaji panicle rows. These have been discarded. In Bungala the hybrids were early-maturing but the grain shattered very badly, whilst in Majimaji they were all taller and much later-maturing.

A short account of rice in the Lake Province is appended as an Annexure. The aim of the rice selection work is to obtain strains of each important variety having as far as possible the following characteristics :—

- (a) High-yield, i.e. high tiller count and large panicle.
- (b) Erectness of growth.
- (c) Non-shattering qualities.
- (d) Absence of red testa.

The description of vegetative habit is denoted as follows :—

1. Erect.
2. Semi-bouquet.
3. Bouquet.
4. Rosette.

The latter is the type whose tillers split at the stool and bend over increasingly as the panicle develops and is of all least desirable. Details of the higher-yielding rice selections which are to be put into strain trials are as follows :—

Sena Mtebe, typically a rosette variety.

2. Semi-bouquet. 3. Bouquet. 5. Rosette.
- Average tiller count, 10·47 per plant.
- Average tiller count of all, 9·87.
- Average yield, 35·10oz.
- Average yield of all, 31·66oz.

Sena India, typically a bouquet variety.

1. Semi-bouquet. 3. Bouquet.
- Average tiller count, 11·22 per plant.
- Average tiller count of all, 10·25.
- Average yield, 29·50oz. per plant.
- Average yield of all, 26·17oz. per plant.

Majimaji, typically an erect variety.

28. Erect. 1. Bouquet.
- Average tiller count, 11·7.
- Average tiller count of all, 10·71.
- Average yield, 36·26oz.
- Average yield of all, 31·66oz.

Bungala, typically a bouquet variety.

9. Bouquet.
- Average tiller count, 7·44.
- Average tiller count of all, 7·52.
- Average yield, 42·19oz.
- Average yield of all, 35·98oz.

Afaa, typically a bouquet variety.

1. Semi-bouquet. 9. Bouquet.
- Average tiller count, 10·69.
- Average tiller count of all, 10·35.
- Average yield, 41·67oz.
- Average yield of all, 39·11oz.

Miscellaneous.

2. Semi-bouquet. 2. Bouquet.

II.—OBSERVATION WORK.

(a) *Mixed vs. Pure Cropping.*—In order that attempts may not be made haphazard to induce natives to follow pure cropping in a rotation system without due assurance that the attempt will lead to no reduction in crop, a trial was laid down to compare simultaneous with alternate rotation. The lay-out did not allow of statistical treatment, but was sufficiently randomized to allow of ordinary fair comparison.

The treatments were :—

- (a) Groundnuts, Cowpea, Maize, mixed.
- (b) „ „ pure.
- (c) Maize, pure.
- (d) Cowpea, pure.

Each replicated four times but, of course, the area under each of the pure crops was as great as the area of the mixed crops, instead of the latter being three times as great:—

Maize (pure) lbs.		Groundnuts kernels (pure) lbs.		Maize and Groundnuts (mixed)		
				Maize	Groundnuts	
66.25	...	42.0	...	22.25	...	20.00
Average yield of native maize per acre 1,096lb.						
50.25	...	45.0	...	27.00	...	19.75
Average yield of native groundnuts 868lb. shelled.						
41.25	...	43.75	...	21.50	...	23.75
1,211lb. unshelled. Percentage nut to husk 66.7%.						
61.50	...	43.75	...	25.00	...	27.75
÷ 4)	219.25	...	173.75	...	95.75	...
Per plot	54.81	...	43.43	...	23.93	...
	20	...	20	...	20	...
Per acre	1,096.20	...	868.60	...	478.60	...
	3c.	...	6c.	...	3c.	...
Shs.	32.8860	...	52.1160	...	14.358	...
	32.886					28.372
						14.358
	52.116				Shs.	42.730

÷ 2) 85.002 per 2 acres.

Shs. 42/50 per acre.

Shs. 42/73 per acre.

The cash return was almost exactly the same from either method of planting, whilst disease was present no more in one treatment than another. Mixed cropping has many disadvantages amongst which the following are the most important:—

1. Desirable cultural operations are not the same for different crops.
2. All crops do not respond to the same extent to the application of manure; maize responds, groundnuts do not.
3. A proper rotation system cannot be involved in complicated and haphazard mixtures of crops.

(b) *Time of Planting of Sesame.*—Four periods of planting were being compared but owing to a bad attack of bacterial leaf spot the trial was a failure. However, observations were made on the disease by the Mycologist and on the insect pests by the Entomologist.

First planting was first slightly attacked by a leaf-curling aphid *Myzus persicae* and by a 20-per cent. infestation of what was probably *Antigastra catalunalis*, the Simsim Webworm, on the apical shoots. All plots were outwardly healthy as regards fungus disease on the 1st February. Black bacterial spots appeared on the leaves on the 2nd February. By the 5th all three treatments were badly affected by bacterial leaf spot, but by the 8th it was thought that the earliest sown plots would survive. However, they were attacked by the aphid again and finally succumbed. The two later plantings were complete failures owing to bacterial leaf spot.

Rainfall.

Total for January	...	...	...	6.43"	} Plants appeared perfectly healthy.
26th January	...	...	...	1.01"	
28th "	...	...	...	.12"	
29th "	...	...	...	.11"	
30th "	...	...	...	.01"	
1st February	...	...	...	1.65"	} Leaves became spotted.
2nd "	...	...	...	.00"	
5th "	...	...	...	1.03"	} All plots very badly affected.
6th "	...	...	...	.15"	
7th "	...	...	...	.08"	
8th "	...	...	...	.16"	

The precipitation of rain was extremely heavy just before the infection began and humidity was probably high. The land was partially water-logged.

(c) *Method of applying various green manures to a crop of Bullrush Millet* :—

Object.—To ascertain whether a green manure crop can be planted, turned in, and a crop of Bullrush Millet taken off in one year, or whether by interplanting in the manner of the Wakara a good stand of green manure can be obtained for digging in prior to next season's crop.

Treatments.—

1. Sunn Hemp planted at first rains and dug in to receive Millet three weeks later.
2. Millet planted first and Sunn Hemp interplanted six weeks before end of rains.
3. Millet planted first but Sunn Hemp replaced by *Crotalaria striata* planted at an earlier date.
4. Control. Bullrush Millet pure.

Agricultural Operations.—

- 16/11/32. Sunn Hemp sown on (1) plots.
 31/12/32. Whole experiment ploughed and Sunn Hemp on (1) plots ploughed under.
 3-4/1/33. Hand ridging of plots except above.
 4/1/33. Sowing broadcast over ridges native fashion, seed of native Bullrush Millet except (1) plots.
 23/1/33. Size of ridges reduced and whole replanted, including (1) plots for first time.
 16/2/33. Interplanting *Crotalaria striata* (above ground on 3/3/33).
 27/4/33. Interplanting Sunn Hemp.

<i>Results.</i> —				Control	Sunn Hemp	Sunn Hemp	<i>Crotalaria striata</i>
				lbs.	dug in	Interplanted	Interplanted
1	...	...	...	28	...	27	28
2	...	...	...	46	...	37	38
3	...	...	...	33	...	28	43
4	...	...	...	36	...	33	29
÷ 4)				143	...	125	138

Plots 1/15th acre each as
 no edging taken off ...

	35.75	...	33.25	...	31.25	...	34.5
	15	...	15	...	15	...	15
Per acre ...	536.25	...	498.75	...	468.75	...	517.5

Owing to the uneven conditions of the land on which the experiment was planted the results could not fairly be put to statistical interpretation, in addition to which, no edging was discarded. At the same time the difference between the control and the plots on which Sunn Hemp was dug in are not great and it can be assumed that under the conditions of the experiment, no great loss of crop should follow the digging in of a green manure crop if allowed to rot for three weeks when land is in a wet condition. During that time 4.47 inches of rain fell. Additionally, the two other treatments could not have been unduly affected by the interplanting of the two species of *Crotalaria*, particularly the Sunn Hemp, which was planted too late to form either sufficient green matter for a green manure or to cause a set-back in the growth of the Millet. The latter could be safely taken as a control in which case the mean of the two sets of control would be almost equivalent to treatment (1) *Crotalaria striata* made fair growth where there were no ant-hills. On the latter it refused to grow altogether. The cover given was not the same as that given in Ukara Island, but there it is planted in September or October, whereas this was not planted till mid-February. It remains to be seen whether it will give sufficient green matter to be worth digging in and whether it will live throughout the dry season. The lowest yields on treatment (3) were given where the *Crotalaria* gave the best stand. Again, the yields were not high owing to the failure to germinate on the 4th January planting, and the necessity to replant on the 23rd of that month. Had the control germinated well there might have been a considerable difference in yield compared with treatment (1) which could not have been sown in any case till the later date, owing to the green manure not having rotted. It appears to be possible to get a crop of Millet when planted after digging in of green manure but not without necessitating a late sowing and consequent reduction in yield. This assumption would hold for areas with a distribution of rainfall like that of Ukiriguru, such as the hinterland areas of Kwimba, Maswa and Mwanza, but it is probable that yield would not be reduced in Ukerewe Island or some of the more favoured Lake shore areas, where rains are invariably earlier.

(d) *Green-manuring in general*.—It is one of the primary aims of experimental work in the Lake Province to evolve a method of green-manuring which will not entail undue labour, and will fit smoothly into the present native agricultural practices. Methods of green-manuring are the following:—

1. *As a catch crop*.—This method is most suitable but depends on the crop used. Sunn Hemp is considered one of the best green manure crops for the area owing to its quick growth, adaptability to catch-cropping and similarity to the indigenous *Crotalaria* of Ukara Island. The yield of green matter on the poor soils which it is intended it should help to regenerate is not high, as in any case the growing period is only six weeks to digging in. Three tons per acre can be expected.

It was tried both before and after Virginia Bunch Groundnuts. In the first case no increase in yield was obtained (the yields on controls and treatments were both low owing to late planting), whereas a decrease would not have been unexpected, as rotting was not quite complete, rains were unfavourable and in any case groundnuts do not respond well to applications of organic matter direct to the crop. In the latter instance, however, a good crop of groundnuts was obtained and green manuring undertaken at a cost of Shs. 7/-

per acre by ox-cultivation after the groundnuts had been harvested. The latter way is obviously the best, but it may be found difficult to induce the native to turn in the Sunn Hemp by hand when no crop is to be planted after it. Sunn Hemp was also obtained and dug in before a crop of Bullrush Millet the latter yielding 500lb. per acre.

2. *As an interplanted crop.*—Interplanting of Sunn Hemp was attempted by the farm headman in between maturing maize and groundnuts with success, though of course the yield of green matter was not heavy. The Ukara method was also tried with *Crotalaria striata*, but the yield of green matter will be rather low.

3. *As part of the rotation, i.e. the only crop on the land during the year.*—This method was not tried but is hardly applicable to Sunn Hemp, which is most profitably dug in at six to eight weeks old in any case. It is not likely to be popular with the natives unless they can sow roughly on fallow.

(e) *General Observations on varieties.*—Attempts were made to ascertain what extent the following varieties of native crops would breed true from bulk seed in the case of (a) to (d) and single heads in the case of Pennisetum :—

- (a) Runner groundnut "Kalande".
- (b) Semi-upright groundnut "Mwitunde".
- (c) Semi-upright cowpea "Kategura".
- (d) Runner cowpea "Nindi".
- (e) Pennisetum "Nhunji".
- (f) "Kasanga".
- (g) "Boya".
- (h) "Ilangi".
- (k) Various varieties of kidney bean.

Neither (a) nor (b) bred absolutely pure; the progeny of Mwitunde were most true to type.

The following types of groundnuts were collected in the field :—

- 1. True runner.
- 2. Straggly runner with large leaves, thick stems, few laterals and very large nuts.
- 3. Semi-upright.
- 4. Upright but with a large number of stems and pegging from near the base only.

It remains to be seen whether the progeny of these single plant selections will breed sufficiently true this coming year to undertake indigenous inter-varietal trials.

(c) Bred true to a large pod, large fawn-coloured seeds, large leaves and semi-upright habit.

(d) Gave runner type only but colour and size of seed very variable.

5. Not much more than 50 per cent. of the progeny of single Pennisetum heads of the different types showed the mother characters.

(f) *Results of infection of cotton plants by insects in cages at Ukiriguru Station.*—In the 1932 cotton season (a notably bad one), it was noticed that a great bulk of the cotton grown on the mainland was affected by some insect pest or virus disease. These symptoms were accompanied by a particularly high infection of white fly on the plants. The symptoms had not been noticed to such a large extent in previous years and the inference was that white fly might have some relation to the disease. This was not borne out by the Entomologist's reports on material forwarded to him and no decision could

be arrived at without further investigation. The noticeable symptoms were as follows :—

- (a) Crumpling of the leaf in a convex fashion.
- (b) A multitude of minute brown abrasions like brown-edged punctures, and holes of varying size, often of considerable size even in the newly-opened leaf-bud.
- (c) A tendency to all spindly growth in the central monopodium and often to abbreviation and malformation in the apical shoots of the sympodia.

On a badly affected plant one would find it difficult to trace a whole undamaged leaf, and the general appearance of the plant indicated a heavy infestation of some insect causing very severe physical damage to the foliage. Yet no such infestation was ever noticed. Three cages of strong muslin were therefore made on wooden frames of sufficient size to allow four plants to grow in each. A similar number of plants was planted immediately outside the cages on the same day. The observations made were as follows :—

CAGE I	CAGE II	CAGE III
Cotton Planted 1/3/33	Planted 1/3/33	Planted 1/3/33
Infected with 447 White Fly adults.	Control. Plants sprayed with solution of Rosin and Caustic Soda.	Infected with both Aphis and Jassid; 229 Jassid, and about same number of Aphis.

PROGRESSIVE INFORMATION ON EFFECT OF INSECTS

Insects first inserted on 13/4/33 when plants of average height of 8 inches. Inspection carried on till 17/5/33; by that time White Fly adults and nymphs numerous. Some leaves were tending to yellow and others had mottled appearance, but otherwise healthy. No physical damage to leaves. Plants growing normally.	First sprayed on 17/3/33.	Insects first inserted on 13/4/33 when plants had average height of 13 inches. By 13/5/33 Aphis had completely covered plants. Basal leaves were losing turgidity, yellowing and reddening and dropping off. Leaves which were semi-developed at insertion of insects were slightly mottled, in some cases reddening at edges but not crinkling in any way. The younger leaves were crinkling downward, saucer-shape, showing chlorosis though greener along the veins. Very young leaves particularly were malformed but no dessication or physical damage to leaves. Sooty mould started appearing on leaf surfaces and resinous condition of surface common to aphid attack became less noticeable. Although Jassid inserted in numbers, they seemed no match for the aphid and did not multiply extensively. Crumpling extensive on younger leaves. By 2/6/33 the condition of plants was becoming worse. A mottled and blotchy appearance was noticeable. All older leaves were flaccid and drooping. Typical crumple of aphid attack not extensive. No crinkle, but certain amount of chlorosis. By the 22nd June plants were beginning to succumb.
--	----------------------------------	---

FINAL CONDITION OF PLANTS

The condition of these plants was worse than that of the control. The plants dried out but as Black Arm disease appeared at that time the effect cannot be entirely ascribed to the White Fly. However, the effect of the White Fly on the plants was very pronounced.	For the conditions under which the plants were growing, these yielded well.	The aphid attack was too much for the plants and they died prematurely.
---	--	--

Discussion.—The leaves of uncaged controls planted outside each cage were all holed in a similar way to the plants in the field and a certain amount of curl was noticed on the younger leaves. No particularly severe infection of any insect took place on cotton outside cages. No plants in the cages, however, showed any signs whatever of this holing or curling. The Assistant Entomologist states: "The experiment would appear to have ruled out Aphis and White Fly as vectors in your cotton troubles." One can conclude that there is some insect responsible for this holing and curling, and tentatively conclude that the insect is neither white fly nor aphis. The infection of Jassid was not severe enough to rule it out entirely. The Assistant Entomologist also stated that "the contrast between cotton kept clean in a cage and the other specimens (outside the cage) is an excellent demonstration of what insects can do to cotton."

III.—EXPERIMENTAL PLOTS.

Experimental lay-out :

1. The Faulkner system is being discontinued in favour of the half-drill strip where one treatment only is to be compared with a control.

2. The experimental work having been initiated only this year, a lesson was learnt in the advisability of having all seed for experiments grown on the farm under observation for at least one year.

3. The futility of supplying seed to plots with bad stands was also demonstrated in the case of many crops. In such cases it is best to take yields per plant and therefore single plants per hole are necessary.

4. As far as possible, crops were planted on ridges in order to conform with native methods, and in allowing for edge effect it was found more convenient to line out the ridges diagonally from one opposite corner to the other. Thus, whatever the variation in the planting distance of the various crops the width of edging to be allowed does not have to vary, so that in the case of one-fortieth acre plots—33 feet by 33 feet—irrespective of width between rows or ridges a uniform size of 40 feet by 40 feet can be taken. Again, this method will be found convenient when splitting the ridges in preliminary cultivation, as "on the square" the ridge in the edging would have to be split off the plot, which would be very inconvenient in manurial trials.

Description of results :

Experiment C.—Groundnut variety trial.

„ D.—Cowpea variety trial.

„ H.—Dipping of Sorghum trial.

„ K.—Manuring of Sorghum trial.

„ O.—Inhibition of Rosette disease trial.

„ P.—Green manuring of groundnuts trial.

Rice variety trial.

Experiment C, 1932-33.

1. Variety trial.

2. Varieties :

Mwitunde, semi-upright type.

Kalande, runner type.

Virginia Bunch, bunch type.

Two Latin squares 3×3 . Plots $1/40$ th acre each.

Analysis of Variance.

Due to :	Degrees of Freedom	Sum of Squares	Mean Squares	$\frac{1}{2} \log e$	
Squares	1 ...	7.347	...	...	...
Columns	4 ...	12.389	...	...	...
Rows	4 ...	9.389	...	...	...
Treatment	2 ...	249.194	...	124.597	...
Error	6 ...	32.917	...	5.486	...
TOTAL	17 ...	311.236			

Calculated value of $z = 1.5616$, observed value of $z = 1.1955$.

Standard Error of Treatment totals = 5.738.

Lbs. of Kernels per acre.

Virginia Bunch	Upright	Semi-Upright	S.E.
496.6	846.4	760.0	38.25

Virginia Bunch.—A significantly lower yielder than either of the two native types. An upright groundnut. Days to maturity 93. Mean yield per acre in unshelled nuts 703.2lb. Shelled 496.6lb. Loss on drying 16.4 per cent. but harvested dry. Percentage of nuts to husk 71. Darker green leaves than native types.

Semi-Upright. "Mwitunde".—A semi-upright runner. Days to maturity 166 days. Mean yield per acre unshelled 1,114.8lb., shelled 846.4lb. Loss on drying 14.3 per cent. Percentage nuts to husk 72.1.

Creeping "Kalande".—A runner groundnut variety. Days to maturity 166. Mean yield per acre unshelled 1,020lb., shelled 760lb. Loss on drying 16.8 per cent. Percentage nuts to husk 69.52.

Summary.—For the season a definite superiority as far as yield was concerned was shown by the two native types, but the period to maturity, 93 days as compared with 166, favours the Virginia Bunch, as also does the ease of harvesting. There are many advantages in an early-maturing nut, of which the following are some :—

1. Facilitates the planting of a catch crop.
2. In areas of favourable rainfall allows two crops to be grown. In areas where there is a risk of rain failing in some years, a crop of Virginia Bunch may be obtained where the native type would fail altogether.
Virginia Bunch matured on 17 inches of rain.
Native types matured on 26 inches of rain.
3. Nuts are an even sample and can be very efficiently shelled by machine.

Operations :—

6th Dec., 1932			
Sown on	Virginia Bunch ...	6" x 16"	(Considered optimum planting distances for each type.
ridges 1 seed to hole.	Semi-upright	8" x 2'	
	runner	10" x 2'6"	

Experiment D, 1932-33.

1. Cowpea variety trial. Kategura Native *vs.* Nindi mixed *vs.* introduced South African from Shinyanga.

2. *Object.*—To determine the yields of these two important native types and the effect of Cowpea Girdler upon their growth.

Randomized Block. 6 blocks of 3 treatments 1/80th acre each.

Analysis Variance.

Due to :	Sum of squares	Degrees of freedom	Mean square	
Total ...	8314.40	17	489.080	Calculated value of
Treatment ...	6309.96	2	3154.980	$z=1.4512$, observed
Blocks ...	273.84	5	54.768	value of z 1% point
Error ...	1730.60	10	173.060	$=1.2929$.

Standard Error of Treatment totals = 31.21.

Yield per acre in lbs. of seed.

Control	Lindi	Kategura	S.E.
270.8	54.0	97.5	26.0

Control definitely a significantly higher yielder. Kategura not significantly a higher yielder than Nindi.

Observations.—Kategura by far the quickest grower. Large foliage. Large Cotyledons. Strong upright growth in first stages. Other two varieties smaller and slower in growth. Kategura tends to be upright and backward in runner production. Runners produced from some way up stem. Stem thicker and appears to be able to callus over Girdler damage more than other varieties. Nindi appeared more susceptible to Girdler. Nindi is a mixture of strains. Nindi and Control very similar but latter very squat indeed. High production of runners in both.

21/2/33. All plots in flower.

15/3/33. Kategura and control fruits maturing, of Nindi still green.

Experiment H, 1932-33.

1. Dipped vs. Undipped Sorghum.

2. To ascertain the value of dipping sorghum seed in copper sulphate previous to planting, in inhibiting Loose and Grain Smut.

3. Faulkner system. 8 treatments and 9 controls. Plots 1/40th acre each.

Plot No.	Percentage infection	
	Dipped	Means of pairs of controls
3 ...	4.16	11.80
5 ...	0.00	10.53
7 ...	5.45	8.53
9 ...	0.00	1.09
11 ...	0.00	1.09
13 ...	2.50	1.85
15 ...	0.00	1.85
Means ...	1.513	5.248

Difference between means in favour of dipping is 3.735. Standard Error of this difference = 1.12.

Summary.—The dipping of seed in copper sulphate resulted in a significant decrease in Smut infection of the seed on the panicles. Smut infection was not heavy enough to affect yield unduly in this particular experiment, and in any case many of the plots were seriously affected by Downy Mildew, so no correlative yields were taken. Counts were taken of the percentage of smutted

main heads in the two centre rows of the 6-row plots. No axillary tillers were counted, only radical ones. Smut in every case except one was Loose Smut. Head Smut was present but not counted. It was noticed that in the dipped plots the main panicle was unaffected but axillary tillers in many cases would be completely damaged by Loose Smut. This hardly seems to conform with the usual movement of the fungus with the plumule up the main axis into the panicle.

Experiment K, 1932-33.

1. Manuring of Pennisetum with unmade native Kraal manure at rate of 7 tons per acre.

2. *Object.*—To ascertain what increase in yield may be expected by this application and to demonstrate to natives its value.

3. Faulkner system. 1/40th acre plots. 8 treatments and 9 controls.

Yield of grain in lbs. per acre. Tiller counts per fifty plants.

Plot No.	Unmanured Means of pairs of adjacent control	Manured	Difference	Unmanured Means of pairs of adjacent control	Manured	Difference
1 ...	...	...	620	...	...	...
2 ...	900	1520	...	114.5	129	14.5
3 ...	...	...	560	...	...	...
4 ...	1000	1560	...	125.5	159	33.5
5 ...	...	...	520	...	...	...
6 ...	920	1440	...	144.0	153	9.0
7 ...	...	...	400	...	...	...
8 ...	1000	1400	...	117.5	153	35.5
9 ...	...	...	80	...	...	...
10 ...	1080	1160	...	106.0	126	20.0
11 ...	...	...	180	...	...	...
12 ...	1020	1200	...	115.5	182	66.5
13 ...	...	...	260	...	...	...
14 ...	1060	1320	...	114.0	160	46.0
15 ...	...	...	60	...	...	...
16 ...	1100	1160	...	141.0	172	31.0
Means	1010	1345	335	122.25	154.25	32.0

37.40 Standard Error.

Summary.—1. The increased yield of grain obtained by the application of manure is definitely significant and so also is the increase of number of tillers. Further, a correlation table shows a dispersion of low yield correlated with low tiller count and high yield with high tiller count.

2. The percentage stand was superior in the case of the manured plots, and whilst they were evened up as much as possible by thinning, the advantage in favour of the manured plots was definitely a result of the manuring itself, as was proved by germination counts.

3. The tiller counts embraced radical tillers only and not those from the axils. The figures exclude the main stems. Tiller production on manured plots showed 28 per cent. increase over control.

4. There were very distinct differences between treatments. Controls were taller, less stocky and with fewer tillers, and flowered and ripened later than the manured plots.

Experiment O, 1932-33.

1. Distance of planting and effect of weeds as factors in inhibition of Rosette disease in groundnuts.
2. To ascertain the effect of extreme narrow and wide planting distances, leaving weedy and clean weeding, on the incidence of Rosette disease.
3. Treatments:—Virginia Bunch Groundnuts.
 - (a) 2 feet apart and weedy.
 - (b) 6 inches apart and clean.
 - (c) 2 feet apart and clean.
 - (d) 6 inches apart and weedy.
4. Latin square 4×4 , plots $25' \times 25'$.

Analysis of Variance.

Due to		Degrees of freedom	Sum of squares		Mean squares	
Rows	...	3	4.130225	...	1.376741	Calculated value of
Columns	...	3	4.337625	...	1.445875	$z = 1.8034$, observ-
Treatments	...	3	179.575725	...	59.858575	ed value of z 1%
Error	...	6	9.806200	...	1.624250	point = 1.6916.
TOTAL ...			15	...	197.849775	

Standard Error of Treatment totals 2.5387.

Mean percentage of Rosette infected plants per plot.

A	B	C	D	S.E.
1.67	9.2	1.33	6.63	.6346

A is significantly less than B and D.
 C " " " " B and D.
 D " just " " B.
 C " not " " A.

Weedy close-spaced gives 7.5 per cent. less Rosette than clean wide-spaced and nearly 5 per cent. less than weedy wide. Clean close-spaced gives nearly 8 per cent. less than clean wide-spaced and over 5 per cent. less than weedy wide. Weedy wide-spaced gives $2\frac{1}{2}$ per cent. less Rosette than clean wide-spaced.

In comparing the effect of delayed weeding on Rosette occurrence, it should be noted that the weed growth of Treatment A was poor and not uniform and comparison of the percentages with Treatment C bears this out, whereas, in making a comparison of Treatments B and D the figures become of value when it is noted that the weed growth was heavy and much more even.

Summary of Results.—Close spacing definitely inhibits Rosette disease and there is an indication that delayed weeding might tend to decrease this inhibition.

Operations.—The first planting of Native Groundnuts gave no Rosette disease at all owing to good planting rains and fairly early planting. The second planting on another site was well infected by Rosette disease.

4th March, 1933. Planting one seed per hole. Weedy plots broadcasted with Teff grass. Three Rosette counts taken and checked between 16th May and 7th June, 1933.

Experiment P, 1932-33.

1. Green manuring of late planted Virginia Bunch Groundnuts.
2. To ascertain whether a crop of Sunn Hemp can be dug in before Virginia Bunch, planted as a late crop, without unduly affecting the yield.
3. Treatments :—
 - (a) Virginia Bunch. Control.
 - (b) Sunn Hemp planted and dug in 46 days later. Virginia Bunch Groundnuts planted 30 days after that.
4. Faulkner system. 8 treatments and 9 controls. 1/20th acre plots.

Plot No.	Dry weight Kernels		Differences between treatments and means of pairs of adjacent controls			
	Control	Treatment	Lbs	S.E. of difference		
2	170	...	...	...	...	...
3	...	190	...	+ 15	...	...
4	180	...	...	...	...	...
5	...	200	...	+ 25	...	...
6	170	...	...	...	...	...
7	...	130	...	—	...	8·88
8	210	...	...	...	...	...
9	...	230	...	+ 20	...	...
10	210	...	...	...	...	...
11	...	130	...	— 65	...	...
12	180	...	...	...	...	...
13	...	190	...	+ 10	...	...
14	180	...	...	...	...	...
15	...	200	...	+ 15	...	...
16	190	...	...	...	...	...
17	...	150	...	— 25	...	...
18	160	...	...	...	...	...
Mean of Control			...	= 185·6		
Mean of Treatment			...	= 177·5		
Difference ...				= 8·1		

The difference does not exceed three times the standard error therefore there was no significant decrease in yield through the digging in of Sunn Hemp previous to planting a late crop of Virginia Bunch Groundnuts.

Operations :—

- 6/1/33. Ridged and Sunn Hemp broadcasted on treatments.
- 21/2/33. Ridging and digging in Sunn Hemp controls.
- 23/3/33. All plots sown two seeds per hole two rows per ridge 6 inches apart each way.
- 6/4/33. Thinned to one per hole.

Observations :—

- 17/3/33. Owing to dry spell Sunn Hemp not yet properly decomposed and also rather close to surface.

Rice Variety Trial.

To ascertain the yield of Majimaji as compared with Sena, the two most popular varieties in the Lake Province. Half-drill strip. Plots 207·4 to the acre. Four rows per plot 60 feet long.

Plot No.	YIELDS IN LBS. PER ACRE			TILLER COUNTS		MEANS PER PLANT	
	Sena	Majimaji	Differences	Sena	Majimaji	Differences	
1	5780		376	10·41		1·18	
2		6156			11·59		
3		6026	836		13·20	2·28	
4	5190			10·92			
5	5073		117	9·73		1·89	
6		5190			11·59		
7		5611	875		12·83	2·37	
8	4736			10·46			
9	4782		693	11·32		2·54	
10		5475			13·86		
11		5047	252		12·93	2·66	
12	4795			10·27			
13	4976		117	11·23		1·23	
14		5093			12·46		
15		5067	647		10·60	1·22	
16	4600			9·38			
17	5488		1212	12·90		1·27	
18		6700			14·17		
19		5870	745		11·70	·32	
20	5125			11·38			
Mean per plot	5054·5	5623·5	569·0	10·86	12·73	1·87	
			S.E. 71·28			S.E. ·201	

Regression of yield difference on tiller count differences is:—

$$\frac{-112·748}{8·1614} = -13·8148$$

Summary.—1. Majimaji is obviously a significantly higher yielder than Sena, and produces a significantly larger number of tillers per plant. The trial was conducted on a medium-heavy black sandy loam close to the Lake shore under good but not swampy water conditions. The yield per acre for Majimaji and Sena was $2\frac{1}{2}$ tons and $2\frac{1}{4}$ tons respectively. The development of the crop was considered to be just above the average of native cultivation, but was by no means as good as will be found in the productive rice valleys of the Mwanza District where it is estimated well over 3 tons per acre is obtained.

2. The analysis of covariance indicates that an increase of one tiller in the tiller difference apparently decreases the yield difference by 13·8, but this decrease is quite insignificant. The mean tiller difference is +3·392 so that the actual difference of yield is not accounted for by extra tillerings. It appears that weight of seed and size of panicle are more important factors in yield increase and it will be of value to bear this in mind in the selection work.

LAKE PROVINCE RICE.

Small quantities of Arabian rice of a round-grained type were being cultivated on the arrival of the Germans, but their cultivation was soon stopped and replaced by varieties introduced from India. In 1908 the Busikera Estate was started by the Germans and six or seven varieties were tried out, the Government helping in their distribution. A rice mill was erected in 1909 at Mwanza and three years later another in Ukerewe. Both were owned by Herr Carl Jungblutt. It is said that there were no other rice mills than these previous to 1914. In 1916 the estimated crop of paddy was 14,000 tons, a large proportion of which was cultivated for the purpose of feeding the troops. In 1922 the industry appeared to be at its lowest ebb, producing only 1,500 tons of paddy giving 900 tons of exportable rice. In 1932 the production of paddy was in the region of 8,000 to 9,000 tons. The principal market is Uganda, and several thousand tons of paddy find their way down the Central Line when freight rates allow it.

2. *Localities of Cultivation.*—All Lake shore areas with the exception of Uzinza, Kome Island, Nassa and the Ukerewe Mainland where its cultivation is restricted. The types of land selected and methods adopted of holding water are as follows:—

- (1) Light soils where seepage over rocks or lateritic pans from springs or other water sources keeps water slowly moving over surface, e.g. Kisesa, Ussukuma, Mwanza.
- (2) Depending on rainfall alone and retentivity of soil. The greatest proportion of rice is planted under these conditions in Mwanza District.
- (3) Impounding water by means of dams or water holes in selected localities where the catchment is good. Practised more often in heavy retentive soils such as are found in Kwimba District.
- (4) Marsh or valley cultivation where soils have high percentage of organic matter and water stands but does not rise unduly high, e.g. Njasisi River, Gongwa River.
- (5) Depending on adjacence of rivers which periodically flood and keep water-level fairly high by flowing through or close to the plantation, e.g. Nyakato River. The soil most generally selected for rice is a medium-textured sandy loam, but the heavier black "Mwibushi" soils are yearly coming more into cultivation but are principally planted under Majimaji.

3. *Methods of Cultivation.*—

- (1) Sowing seed in nursery at the beginning of the rains and transplanting when 10 to 20 inches high. A method practised far more than any other.
- (2) Sowing in clumps *in situ*, and transplanting from the bunches.
- (3) Broadcasting *in situ*. Often the seedlings are allowed to grow too tall (10 inches is probably optimum size); too many seedlings are planted per hole (one to three seedlings is the optimum number); and insufficient attention is paid to the seed-beds. Weeding in the early stages and superficial surface-stirring are important operations.

4. *Yields.*—In a good year $1\frac{1}{2}$ tons per acre of paddy is probably the average, whereas in a bad year it may be as little as $\frac{3}{4}$ of a ton. In valleys where water conditions are good, $2\frac{1}{2}$ to 3 tons or even more may be obtained.

5. *Classification of varieties.*—This will be found as an annexure at the end of the report.

6. *Comparative observations on characteristics of varieties: Majimaji.*—The most important and lowest-priced rice of all. It is unfortunately a white-seeded rice and on this account defies easy separation from the bad rices such as the two Kalundes and Tchamata, and other similar but not necessarily bad varieties. Hence commercially it is a conglomeration of numerous varieties, which does not appear to deleteriously affect its quality for the Uganda trade, but certainly would, if any attempt was made to export. It appears to grow better under varying conditions than any other local variety and will be found on soils varying from sandy to the heavy black "Ibushi" and "Mbuga" type. Similarly it will grow under a great variety of water conditions. The lowest yields will be obtained, of course, under poor water conditions and on sandy soils. It is typically an erect type, standing up well to storms, and will tiller more than any of the other local types. So far, it is undoubtedly the most suited of local rices for general cultivation and can be trusted to yield under any of the conditions detailed under paragraph 2, except on the more sandy soils where Sena will prove best.

Sena.—This rice is confined principally to the Lake shore and island areas, where light soils predominate. The two types "Mtebe" and "India" differ principally in the size of panicle and seed. "Mtebe" lodges more easily. Neither are grown to any extent separately. "Sena ya Bukwimba" is a type that has been cultivated by a few natives in the district of that name. It appears to grow better on heavier soils than its namesakes and prefers heavier water conditions. Its seed is much broader and the panicle is large. A more robust plant than either "Mtebe" or "India". The Senas, the only brown-husked rices of the Province command a price between that of Majimaji and Bungala and Afaa. Strains with a red testa are to be found in the Sena population.

Bungala.—Definitely, this rice desires plenty of water, and is planted almost pure only in Ukerewe and a few special areas like Kayenze on the Mwanza mainland. Its value as a high-priced rice varies considerably and probably the demand is limited, and heavy supplies would lower the price. Its tiller production is low but weight of panicle high. It is valued for the distinctive flavour of the grain.

Afaa.—This type, introduced amongst many others, by Herr Carl Jungblutt and planted every year on his plantation commands the highest price of all. Like Bungala, it has a distinctive flavour, it is grown by very few natives and is high-yielding. Similar in growth to Majimaji, it desires, however, a fair amount of water. Its tiller count is high and size of panicle average. Its possibilities, owing to its high price, might well be investigated.

Undesirable rices.—The rest of the varieties may be considered as undesirable, for various reasons. It is difficult to estimate their trade value owing to the trade being only an African one and not of long standing. However, Sindano does not appear to be of particular importance, is very mixed, the desirable thin-seeded type not being the only one grown, and cannot compete for popularity with Majimaji. Tchamata or Kanuke is a somewhat glutinous soft-grained rice of good flavour, but of no importance. The two distinct Kalunde types are definitely undesirable owing to their broad seed, soft grain, predominance of red testa and low yield.

7. *Yields: Effect of planting mixed seed.*—The mixing of varieties is one which affects yields very considerably. Very few rice holdings will be found to be pure to any one variety. Sena is the most pure of all, but even this has an admixture of brown-husked broad-seeded strains with red testa and low yield which appear to be crosses between Sena and Kalunde. Majimaji is very mixed indeed, particularly with Kalunde and Sindano and variations of these. Selection of panicles true to type, at harvest, would obviate this. The value of planting seed free from the low-yielding easily lodging Kalunde types is obvious, and although there is much to be said for the method of planting two varieties together, as done in the East, the components of the present mixture would not serve the purpose of safeguarding a moisture-loving crop in a dry season or *vice versa*. An average cash return per acre to a native from rice is in the region of Shs. 120/-. The average size of holding is probably one-twelfth acre.

8. *Extension of cultivation.*—This will have to be undertaken principally in the "Mbuga" black soil areas of the mainland, where with damming of the bottom of a rain catchment area, water can be impounded and in years of average rainfall, good crops of rice obtained. Extension in the hinterland southwards other than in "Mbuga", has to take the form of terracing, with enclosing bunds to collect all available rainwater. Extensive cultivation on the latter system is rather risky as good yields are not possible every year. There are very few opportunities for planting on the edge of the Lake without an irrigation scheme, as there are few areas which slope sufficiently gently to the lake side and allow water to stand. Also, alkali is prominent in many areas near the lake.

9. *Marketing.*—All is now sold for cash and in Mwanza District is purchased by varieties—Majimaji, Sena, Bungala and miscellaneous—at the various ruling prices thus demonstrating to the natives the differentiation in price between them and assuring a fairer deal.

RICE.
CLASSIFICATION OF VARIETIES.

Variety	General Vegetative habit	Mean Height	Mean No. Tillers	Period to Maturity Days	Type of Panicle	Shattering quality
1. Majimaji	Erect to semi-bouquet	3' 9"	12	160	Medium, not so loose as No. 2	Good
2. Sena Mtebe	Rosette	3' 3"	10	155	Large, loose and drooping	Bad
3. Sena India	Bouquet to semi-bouquet	3'	10	150	Smaller than No. 2 and not drooping	Fair
4. Bungala	Bouquet	4'	7	155	Heavy, long drooping and loose	Very good
5. Sindano	Rosette bouquet	3' 3"	9	155	As No. 1	Good
6. Afaa	Bouquet	3' 6"	10	160	Longer and larger than No. 1	Slight
7. Tchamata or Kanuke	Bouquet to semi-bouquet	3' 9"	6	145	Drooping and heavy	Good
8. Sena ya Kwimba ...	Bouquet	3' 6"	11	150	As No. 2	Fair
9. Kalunde	(a) Early maturing rosette (b) Late maturing rosette	3' 3"	6	(a)=135 (b)=150	Light, upright and firm	Fair

RICE.

CLASSIFICATION OF VARIETIES.—(contd.)

Colour of Grain	Shape of Grain	Awnedness	Colour of Testa	Soil preferred	Water requirement
1. Pale straw	Medium blunt	None	White	Medium heavy to heavy	Can grow under the most variable conditions
2. Rich golden brown	Long and thin	Mainly awnless	White but strains with red testa have been found	Sandy to medium heavy	Medium
3. As No. 2	Long, thin, smaller than No. 2	Mainly awnless	White as No. 2	Sandy to medium heavy	Medium
4. Deep straw brown with purple tip	Medium plump pointed	Short awn	Yellowish-white	Medium heavy soils	Medium heavy
5. Bright yellow often with brown stripes	Broad plump to pointed long	Variable	White	Medium heavy	Medium heavy
6. Rich straw with translucent appearance	As No. 1 but larger	None	White	Medium heavy	Medium heavy
7. Softly hairy, cream white	Large, broad	None	Chalky	Medium heavy	Medium
8. Rich brown	Broad	Variable	Strains with red testa known	Medium heavy	Medium heavy
9. Dull straw	Very broad	(a) Awnless (b) Some awned	Variable but red testa very common	Any	Variable— (a) White sheath (b) Red sheath

N. V. ROUNCE,
District Agricultural Officer.

ANNEXURE IX.

EXTRACTS FROM THE REPORT OF THE AGRICULTURAL LECTURER ON THE NYAKATO AGRICULTURAL TRAINING CENTRE.

1. Pupils have been accepted for a course of two years. There are two terms a year: 1st February until 31st July, and 1st September until 22nd December. Test examinations in all subjects are held in July and the examinations held during the year proved that the majority of the pupils had made satisfactory and even astonishing progress.

2. In addition to their academic teaching in the classroom the pupils are taught elementary plant physiology, elementary soil science, agricultural practices in theory, and a course on coffee cultivation. All these subjects have been amply backed up with demonstration work in the field, or with the microscope, or with plants growing in glass jars.

3. Pupils have so far been drawn only from those areas in the Lake Province where coffee can be successfully grown. The teaching of coffee cultivation forms the chief interest and everything taught is made to serve and assist the industry. Crops other than coffee have been dealt with only when they fit in with the requirements of the native farmer in those areas where coffee is grown, or can be made to form a useful adjunct to the coffee industry.

4. Hard development work in the field is carried out by small labour gangs but the pupils in turn are required to assist even in this work for short periods. All maintenance work such as cleaning, grass cutting, and weeding is carried out by the pupils. Nursery work, planting and sowing of crops, ridging and reaping, is all carried out by the pupils and it should not be long before very little labour is necessary and the school self-supporting. Since the pupils have been shown that they are here to be taught and not merely to be used as labourers, they have shown ample enthusiasm and have not objected to any of the work involved.

5. Rough carpentry and masonry is also being taught to apply to them as farmers in after life or as coffee growers. They have been engaged on the making of field step ladders for picking coffee, on making coffee drying trays, and also wooden coffee pulpers such as the Chagga use on Kilimanjaro. In addition they have been taught the construction of a hide shade-drying shed and of cattle byres of modern design including stone and cement dung channels and feeding troughs.

6. It is assumed that places may be found for the more intelligent boys who desire to enter as employees of the Agricultural, Veterinary, or Forests Departments or under the Native Authorities. Others may find a living and trade in agricultural carpentry or stone masonry, in hide drying, or by constructing small coffee pulperies. The majority will at least leave Nyakato as trained peasant farmers.

ADULT CLASS.

7. It was decided to give an annual course of lectures and demonstrations on coffee cultivation to adults who lived not too far away and could regularly

attend once weekly. This was carried out during 1933 commencing in June with a regular average attendance of ten men. Six have asked to go through the course again so that they may watch development in accordance with my teaching on the coffee demonstration plots.

OLD NATIVE AUTHORITY SUB-STATION.

8. The old sub-station was formerly in charge of the District Agricultural Officer. This was situated near to the training centre. It was decided to move it to within the boundaries of the training centre in accordance with approval of the District Officer, Bukoba, the District Agricultural Officer, Bukoba, and the responsible Native Authorities. The grant from Native Treasuries towards its upkeep is continued. Closer supervision and better progress can now be ensured and we and the pupils have the advantage of a larger demonstration area within the school.

9. An acre and a half of land was cultivated and terraced under a plan to demonstrate the prevention of soil erosion. The area comprises 60 plots of 100-square yards each in rows of ten. Crops were sown as follows:—

Crop sown	No. of plots manured.	No. of plots without manure
English potatoes	5	5
Earth peas	5	5
Creeping groundnuts	5	5
Bunch groundnuts	5	5
Sunflowers (for poultry feed) ...	5	5
Buck wheat	3	2
Sweet potatoes	2	3

10. A demonstration of the value of properly prepared compost manure is arranged for. Alternate plots being manured. The proper cultivation and spacing of the various crops are also being demonstrated. Most of the work has been carried out by the pupils. Crops are all about half-matured so that it will be impossible to include yields in this annual report.

NURSERIES.

11. Half an acre of land has been developed and laid out at the foot of the high level water supply. A sufficient number of beds were prepared and had to be properly manured on account of the prevalent soil problem. Rolling cane matting was constructed for shade. The following varieties of coffee were sown, germinated well, and will be ready for planting with the big rains in 1934:—

ROBUSTA.	ARABIAN.
Local selection No. 1. ...	Local selection Bourbon strain.
„ „ No. 2. ...	Kents strain ex Moshi.
„ „ No. 3. ...	Nyassa strain ex Uganda.
„ „ No. 4. ...	Menado strain ex Usambara.
Quillo ex Java <i>via</i> Amani ...	
Uganda selection No. 9.	

COFFEE DEMONSTRATION AREA.

12. Reports had intimated that the soil throughout the area of the proposed Agricultural Training Centre was so poor that very few crops would grow successfully or give economic yields. It was suggested, therefore, that a fertile area should be found without the boundaries on which to develop a coffee demonstration field. It was not then understood that the whole countryside

is cursed with the same soil problem that has undoubtedly gradually come into being on account of the wasteful and primitive methods of cultivation and stock grazing followed by the native population from generation to generation and still in vogue. Fertility has only been partially maintained in the banana groves and villages where kitchen refuse, vegetable refuse, and such animal excreta as has been available, has been mulched on to the land in somewhat haphazard and wasteful fashion since settlement began. It was not possible to requisition such land on which the food supply of a village depended and the only alternative was to use the land we had, to overcome the soil problem, bring it to a proper state of fertility, and thereby teach the native what could be done to save further erosion and bring the wide open spaces of infertile soil to full fertility.

13. Indication had already been given on the old sub-station that this could be done by (a) terrace or contour cultivation; (b) the aeration of the sub-soil; (c) the addition of heavy dressings of properly prepared "compost" or farm-yard manure; (d) by mulching; and (e) by proper crop succession. We inherited from the Education Department several mounds of decayed vegetable refuse approximating thirty-five tons. We manufactured another ten tons of similar material and have also manufactured approximately one hundred and fifteen tons of "compost" manure during the year. Compost manure consists of about ten per cent. manure and bedding from cattle byres mixed and added to ninety per cent. cut grass and vegetable refuse, properly turned and treated with moisture until it decays and becomes a manurial substance of high value.

14. Three acres of land have been allocated for planting coffee. A two-acre plot for Robusta, and a one-acre plot for Arabian, on the principle that the coffee exports from Bukoba District at the present time are roughly two-thirds Robusta and one-third Arabian. These areas have been divided into four strips each—half acre and quarter acre respectively, and developed in accordance with four treatments. The treatments are as follows:—

- (a) Heavy dressing of decayed vegetable matter dug into surface. The burying of subsequent weed growth. Mulching with cut grass and banana refuse.
- (b) Bastard trenching and subsoiling with heavy double application of compost or farmyard manure. Burying of subsequent weed growth. Mulching with cut grass and banana refuse. Cultivation of green manure crops. Intensive cultivation.
- (c) Heavy dressing of farmyard manure dug into surface. Burying of weed growth. Mulching.
- (d) Subsoiling to depth of two feet. Cultivation of green manure crops only.

15. Treatments (a) and (d) have been completed on both plots. Treatment (b) is nearly complete for both plots. Treatment (c) is yet to begin. The areas will be ready for planting with the big rains about April, 1934. The lay-out will allow for proper records without marginal interference. Various methods of pruning will be demonstrated together with the trial response of the separate varieties under local conditions.

OSIERS AND RICE.

16. The boundary encloses a quarter of an acre of swampy land that crosses a neighbouring stream. This has been developed and partially drained by constructing raised beds with ditches between. Two hundred Osier cuttings

were obtained from Lushoto and were planted in a temporary position. They are now rooted and will shortly be transferred to their proper site. The idea is to provide good basket making material that is lacking in the district, to teach the pupils the possible trade of basket making, and hence provide efficient baskets to deal with the coffee when the annual crop is being gathered.

17. A ramp or dam has been thrown across the stream so that this particular area can be flooded at will when a sluice gate is constructed. It is hoped to demonstrate the cultivation of rice when this has been done. The chiefs in conference in 1930 asked the Agricultural Department to teach the people to grow rice.

CO-OPERATION WITH FORESTRY DEPARTMENT.

18. With fifty pupils in residence, a great deal of firewood is required for kitchen purposes. Rough timber is required for many purposes such as the building of sheds and bandas, the construction of fences, nursery shade and so forth. Much of our land bordering the stream is steeply sloping, rocky, thinly covered with soil and useless for most purposes. A beginning has been made to get the whole of this area planted with quick-growing trees. The Assistant Conservator of Forests in the persons of firstly Mr. Herring and secondly Mr. Pitt-Schenkel have given willing co-operation, assistance in seed supplies and advice. Co-operation has grown towards the use of this area for demonstrations in forestry work, towards the laying down of a nursery for distribution of plants, and towards the giving of a course of lectures on Forestry by the Assistant Conservator of Forests to the pupils so conveniently gathered together at our training centre.

19. In connection with this work and to create base lines, about one-half of the boundary lines have been flagged and demarcated with a six-foot pathway and an enclosing hedge. Cuttings of *Erythrina tomentosa*, seed of *Cassia floribunda*, both obtained locally, and seed of the Mauritius thorn obtained from Kilimanjaro, have been used for comparison. The latter should form a hedge that neither man nor beast can penetrate and help to solve the difficulty of cultivating crops where wild pig abound in many parts of the district.

20. A total of about six acres of steeply sloping land have been cultivated in contour strips and part planted with trees.

CO-OPERATION WITH VETERINARY DEPARTMENT.

21. The Veterinary Department had five Zebu oxen brought from Musoma to test immunity to East Coast fever. These were stabled and herded about a mile distant. The Veterinary Officer intended to increase his stock and match Ankole and Zebu cattle for various trials. He had no facilities for carrying out animal husbandry work and found it difficult enough to supervise his small herd of oxen some six miles distant from Bukoba. We came to an arrangement to cart away the manure for compost making and had meanwhile found an interest in the obvious ease with which the natural grazing at Nyakato could be improved along the lines recently justified at the Jeallots Hill Experiment Station of the Imperial Chemical Industries, Ltd., in England.

STOCK.

22. The five Zebu oxen were therefore moved to temporary housing at Nyakato and the herdsman paid by Native Treasuries brought under closer supervision. These oxen rapidly improved in health, have given valuable quantities of manure, and are available for use for cultivating with mechanical implements.

23. Including the five oxen there are twenty-five head now housed at Nyakato. Full particulars have been registered in a Herd Book and each beast earmarked with a numbered metal clip.

CATTLE BYRE.

24. A cattle byre has been built to house thirty head of adult stock in two lines of double stalls. It includes a clean milking room, a dairy, a calf pen, and a manure or calving pen. It is built to modern design but of native materials, and allows for stall feeding and the preservation of all animal excreta. A drinking trough has been constructed alongside and served with a continual flow of spring water.

25. We benefit by the fitting in of animal husbandry work with agricultural pursuits and the valuable amount of manure available for our demonstration areas. In return we provide necessary supervision. The pupils in residence take part in the work, and are available for teaching and lectures by the Veterinary Officer, Bukoba.

APPENDIX I.

LIST OF EUROPEAN STAFF AS ON 31ST DECEMBER, 1933.

DIRECTOR: E. Harrison, Head Office, Morogoro.

ASSISTANT TO DIRECTOR: L. A. W. Vickers-Haviland (seconded from Provincial Administration), Head Office, Morogoro.

SENIOR AGRICULTURAL OFFICERS: C. K. Latham, Lindi; A. S. Richardson, Mwanza; A. J. Wakefield, on leave.

AGRICULTURAL LECTURER: A. E. Haarer, Nyakato (Bukoba).

CHIEF SCIENTIFIC OFFICER: S. M. Gilbert (not yet arrived).

ENTOMOLOGIST: A. H. Ritchie, on leave.

ASSISTANT ENTOMOLOGIST: W. V. Harris, Laboratory, Morogoro.

MYCOLOGIST: G. B. Wallace, Laboratory, Morogoro.

AGRICULTURAL CHEMIST: H. B. Stent, temporarily stationed at Amani.

DISTRICT AGRICULTURAL OFFICERS: L. C. Edwards, on leave pending termination of appointment; C. M. H. Sutherland, on leave pending termination of appointment; J. V. R. Brown, Kilosa; C. B. Garnett, Dar es Salaam; D. Sturdy, Arusha; R. M. Davies, on leave; H. Musk, Mpanganya; C. Harvey, Moshi; A. S. Stenhouse, Masasi; H. Marsland, Shinyanga; C. J. McGregor, on leave; A. H. Savile, Bukoba; N. V. Rounce, Mwanza; T. C. Cairns, Tabora; R. D. Linton, Tabora; B. J. Hartley, Mwanza; F. R. Sanders, Moshi; J. Robertson, Experiment Station, Morogoro; F. W. Thomas, Lushoto; R. B. Allnutt, on leave; J. R. Curry, Singida; N. R. Fuggles-Couchman, on leave; G. W. Lock, Lushoto; D. Thornton, on leave; J. G. M. King, Morogoro; J. C. Eyre, Tanga.

SENIOR AGRICULTURAL ASSISTANT: T. H. Marshall, Experiment Station and Head Office, Morogoro.

AGRICULTURAL ASSISTANTS: E. T. Ward, Iringa; R. W. Collett, Mpapura; T. S. Jervis, Bukoba; L. Leslie-Moore, Bagamoyo; G. S. Brown, Dar es Salaam; B. E. Eustace, Tukuyu; A. Taylor, Moshi; W. Sibley-Warne, Mpanganya; C. J. M. Krige, on leave; W. C. Clarke, on leave; A. Young, Bugufi; L. F. Higgins, Moshi; H. Gillman, Mwanza; R. Seager, Mwanza; A. E. Twells, Songea; A. E. Weirich, Coffee Research Station, Moshi.

CHIEF CLERK: W. E. Pownall, Head Office, Morogoro.

EUROPEAN CLERKS: C. H. Taylor and D. F. T. Brown, Head Office, Morogoro; J. B. Hean, on leave.

APPENDIX II.

PLANT AND SEED INTRODUCTIONS, 1933.

- Pyrethrum, *Chrysanthemum cinerariæfolium* (from Kenya).
 Mango scions (from India).
 Lucerne (from Kenya).
 Cinnamon (from Amani).
 Queensland nut, *Macadamia ternifolia* (from New South Wales).
Acacia molissima (from South Africa).
 „ *pycnantha* („ „ „).
 „ *Baileyana* („ „ „).
Eucalyptus longifolia („ „ „).
 „ *Globulus* („ „ „).
 „ *ficifolia* („ „ „).
Cupressus sempervirens („ „ „).
 Pumpkin, var. Iron Bark (from Southern Rhodesia).
 Kudzu, *Peuraria Thunbergiana* (from Japan and South Africa).
Coffee excelsa (from Amani).
 Pecan nut (from South Africa).
 Broom corn (from South Africa).
Cymbopogon Nardus (from Uganda).
 Velvet bean (from Southern Rhodesia).
 Cape Early barley (from South Africa).
 „ „ rye („ „ „).
 Stooling „ („ „ „).
 Apple plants („ „ „).
 Peach „ („ „ „).
 Vine „ („ „ „).
 Tobacco, var. Heavy Western (from Nyasaland).
 „ „ Blue Pryor (from Uganda).
 „ „ White Stem Orinoco („ „ „).
 „ „ Hickory Pryor („ „ „).
 „ „ Amorelo (from South Africa).
 Vetches (three varieties) („ „ „).
 Seven year bean („ „ „).
 Mustard („ „ „).
Rosa damascena (from Cyprus and India).

APPENDIX III.

LIST OF GINNERIES EXISTING IN 1933.

Province and District	Locality	Last licensed	No. of Gins		Licencee
			Saw	Roller	
<i>Eastern :</i>					
Dar es Salaam	Ruvu	1933/34	1	26	Vithaldas Haridas & Co., Ltd.
"	Pugu	1932/33	1	18	Abdulrasul and Sons
Morogoro ...	Morogoro ...	1933/34	1	28	Tanganyika Cotton Co., Ltd.
"	Mikese	"	—	20	Japan Cotton Trading Co.
"	Ngerengere ...	"	—	16	Liverpool-Uganda Co., Ltd.
"	Mlali	1930/31	—	18	Tanganyika Cotton Co., Ltd.
"	Duthumi ...	1933/34	1	12	" " "
"	Mkata	1930/31	—	12	" " "
"	Turiani	1931/32	—	13	" " "
Kilosa	Kilosa	1933/34	—	18	Juma Haji
"	*Kimamba ...	"	—	12	Kimamba Planters Ginning Co., Ltd.
"	Rudewa	"	1	14	Tanganyika Cotton Co., Ltd.
"	Msowero	"	—	12	Kladitis and Samaris
Bagamoyo ...	Mandera	"	—	8	Holy Ghost Mission
"	†Kisauke ...	1928/29	—	2	S. G. Drosopoulos
Rufiji	Kilimani ...	1933/34	—	12	Kilimani Plantation
"	Msomeni	"	—	—	Liverpool-Uganda Co., Ltd.
"	Logeloge	"	—	8	D. Kepetsakas
Mahenge ...	Kiberege	"	—	13	Vithaldas Haridas & Co., Ltd.
<i>Lindi :</i>					
Lindi	Lindi	1931/32	—	13	Mathurdas Kalidas
"	Mtua	1933/34	—	6	" " "
Kilwa	Kikanda	1930/31	1	8	Jaffer Somji & Co.
<i>Tanga :</i>					
Tanga	Tongoni	1929/30	1	8	G. Galanos
Handeni ...	Mamundu ...	1928/29	1	—	Kwashemshi Estates
"	Sinden	1933/34	1	2	" "
<i>Northern :</i>					
Moshi	Moshi	1933/34	—	6	Moshi Trading Co.
"	Himo	1932/33	1	12	" " "
Mbulu	Idulu	1926/27	—	5	M. Michaelakis
<i>Western :</i>					
Shinyanga ...	Usogore	1933/34	—	6	Bhagwanji Sunderji & Co.
"	Luhombo	1930/31	4	—	B.E.A. Corporation, Ltd.
<i>Lake :</i>					
Mwanza	Mwanza	1933/34	—	20	Nakasero Trading Co., Ltd.
"	Murutunguru ...	"	1	10	White Fathers Mission
"	Ihale	"	—	11	Mwanza Cotton Trading Co.
"	Bukumbi	"	—	12	Bhagwanji Sunderji & Co.
Kwimba	Nyambiti ...	1932/33	2	6	British Cotton Growing Assoc.
"	Pambani	1933/34	—	17	Kampala General Agency
Maswa	Nyanguge ...	1930/31	2	8	British Cotton Growing Assoc.
"	Runere	"	5	—	B.E.A. Corporation, Ltd.
"	Malampaka ...	"	5	—	" "
"	Nasa	1933/34	—	12	Narandas Rajaram & Co.
Biharamulo ...	Biharamulo ...	1930/31	2	—	British Cotton Growing Assoc.

*Non-Native cotton only.

†Private ginnery.

APPENDIX IV.
TANGANYIKA TERRITORY—PRINCIPAL EXPORTS, 1913 AND 1929-33

Export	1913		1929		1930		1931		1932		1933	
	Quantity	Value £	Quantity	Value £	Quantity	Value £	Quantity	Value £	Quantity	Value £	Quantity	Value £
Sisal	Cwts. 416,680	535,580	Cwts. 914,560	1,485,593	Cwts. 999,240	1,172,315	Cwts. 1,118,780	707,177	Cwts. 1,211,080	698,202	Cwts. 1,392,000	881,772
Hides and skins ...	69,120	274,511	50,988	223,002	41,872	123,471	42,220	83,915	54,360	99,474	82,800	165,382
Cotton	43,840	120,753	98,948	487,863	73,414	247,413	48,526	119,752	64,180	183,747	101,500	276,864
Copra	109,540	117,401	158,400	145,015	147,900	109,733	144,680	62,209	145,300	64,694	163,140	62,160
Groundnuts	179,220	95,932	155,300	120,448	346,660	186,567	61,400	28,706	317,460	182,010	383,540	166,223
Beeswax	11,180	70,743	6,721	48,149	3,773	20,297	12,143	47,010	7,820	31,965	13,600	52,751
Coffee (raw)	21,180	46,563	177,140	588,871	230,940	397,040	185,020	247,037	227,240	463,597	254,360	429,523
Sesame	29,520	20,407	85,120	74,773	62,300	32,547	76,560	36,715	96,220	50,130	88,820	41,845
Rice	15,420	8,717	51,884	58,985	90,131	73,682	95,095	51,209	107,700	62,939	125,860	62,382
Millet	18,210	5,498	95,323	30,334	36,288	8,234	105,407	20,710	70,580	14,911	5,260	1,005
Total	913,910	1,296,105	1,794,384	3,263,033	2,032,518	2,371,299	1,889,831	1,404,440	2,301,940	1,851,669	2,610,880	2,139,907

APPENDIX V.

DETAILS OF EXPENDITURE.

The following table shows the provision and estimated expenditure for the period 1st January to 31st December, 1933:—

	Provision for the period 1/1/33 to 31/12/33	Estimated Expenditure for the period 1/1/33 to 31/12/33
<i>Personal Emoluments.</i>		
	£	£
Administrative (including total cost of Headquarter's staff)	5,004	4,805
Scientific staff	2,309	2,309
Field and Experiment Farm staff	27,799	27,371
Total Personal Emoluments ...	35,112	34,485
<i>Other Charges.</i>		
Travelling (including Railway Fares and Freight, Travelling and Transport Allowances, Transport and Passages)	10,160	8,243
Upkeep of Experiment Stations and Plantations ...	3,850	3,640
Purchase of Seeds and Upkeep of Ploughing Schools...	350	290
Plant Sanitation and Purchase of Scientific Equipment	450	384
Expenditure from Cotton Cess	3,000	2,550
Agricultural Development, Special Services	500	185
General Expenditure	839	848
Contributions:—		
(a) Scholarship Scheme	665	665
(b) Imperial Agricultural Bureaux	200	200
(c) Imperial Bureau of Entomology	400	400
(d) Imperial Bureau of Mycology	250	250
(e) East African Agricultural Research Station ...	6,000	6,000
(f) Colonial Agricultural Service—Central Fund ...	180	180
Total Other Charges ...	26,844	23,835
<i>Special Expenditure.</i>		
Anti-locust Measures	1,000	120
Purchase of Native Tobacco	500	450
Purchase of Tea Seed	300	187
Nyakato Agricultural School	500	500
Coffee Research Station	4,000	800
Total Special Expenditure ...	6,300	2,057